85-1108

No.

Supreme Court, U.S.
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IN THE

Supreme Court of the United States

OCTOBER TERM, 1985

DELTA RESINS & REFRACTORIES, INC., et al.,
Petitioners,

v.

ASHLAND OIL, INC.,
Respondent.

PETITION FOR WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

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December 24, 1985

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QUESTIONS PRESENTED

The Court of Appeals for the Federal Circuit reversed the Judgment of the District Court that the claims of three patents were invalid for obviousness.

1. Whether the technical expertise of the Court of Appeals for the Federal Circuit allows it to apply Rule 52(a) differently from the other Courts of Appeal and discount the testimony of Defendants' expert witness, asserting the witness was not an expert, and substitute its own factual determinations for findings of fact made by the District Court after a trial that included ten days of live witness testimony?

2. Whether Defendants have been deprived of Due Process by the Court of Appeals for the Federal Circuit disregard of the opinions of Defendants' expert asserting that the opinions were not probative because they lacked factual support, when no objection as to the lack of factual support for the opinions was raised at trial as required by Rule 103 of the Federal Rules of Evidence.

STATEMENT PURSUANT TO RULE 21(b)

In addition to the parties listed in the caption of the case, Defendants below included Aristo Corporation, David J. Horstman, Gary Lukacek, and Lawrence D. Kancius.

STATEMENTS PURSUANT TO RULE 28.1

Petitioner, Delta Resins & Refractories Inc., is a privately held corporation of Wisconsin.

Aristo Corporation is wholly owned by Delta.

David J. Horstman, Gary Lukacek and Lawrence D. Kancius are employees of Delta.

There are no publicly held affiliates of Delta.

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v.

ASHLAND OIL, INC.,
Respondent.

PETITION FOR WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Petitioners Delta Resins & Refractories, Inc., et al. pray that a Writ of Certiorari issue to review the Judgment of the United States Court of Appeals for the Federal Circuit.

OPINIONS BELOW

The Opinion of the Court of Appeals for the Federal Circuit is reported at 776 F.2d 28, and is included in the Appendix to this Petition at 1a. The Opinion of the District Court is reported at 587 F.Supp 1406 and is reprinted in the Appendix at 55a.

GROUNDS OF JURISDICTION

The Judgment of the Court of Appeals for the Federal Circuit was entered on October 25, 1985. No petition for rehearing was filed. Jurisdiction of this Court is conferred by 28 U.S.C. §1254(1).

STATUTES AND REGULATIONS INVOLVED

Federal Rules of Civil Procedure:

Rule 52. Findings by the Court

(a) Effect. In all actions tried upon the facts without a jury or with an advisory jury, the court shall find the facts specially and state separately its conclusions of law thereon, and judgment shall be entered pursuant to Rule 58; and in granting or refusing interlocutory injunctions the court shall similarly set forth the findings of fact and conclusions of law which constitute the grounds of its action. Requests for findings are not necessary for purposes of review. Findings of fact, whether based on oral or documentary evidence, shall not be set aside unless clearly erroneous, and due regard shall be given to the opportunity of the trial court to judge of the credibility of the witnesses. The findings of a master, to the extent that the court adopts them, shall be considered as the findings of the court. It will be sufficient if the findings of fact and conclusions of law are stated orally and recorded in open court following the close of the evidence or appear in an opinion or memorandum of decision filed by the court. Findings of fact and conclusions of law are unnecessary on decisions of motions under Rules 12 or 56 or any other motion except as provided in Rule 41(b).

Federal Rules of Evidence:

Rule 103. Rulings on Evidence

(a) Effect of erroneous ruling. Error may not be predicated upon a ruling which admits or excludes evidence unless a substantial right of the party is affected, and

> **(1) Objection.** In case the ruling is one admitting evidence, a timely objection or motion to strike appears of record, stating the specific ground of objection, if the specific ground was not apparent from the context; or

Federal Rules of Evidence:

Rule 705. Disclosure of Facts or Data Underlying Expert Opinion

The expert may testify in terms of opinion or inference and give his reasons therefor without prior disclosure of the underlying facts or data, unless the court requires otherwise. The expert may in any event be required to disclose the underlying facts or data on cross-examination.

STATEMENT OF THE CASE

A. Proceedings Below—Milwaukee

In 1976 Ashland Oil, Inc. ("Ashland") brought a patent infringement suit in the Eastern District of Wisconsin (Milwaukee) charging Petitioner Delta Resins & Refractories, Inc., et al. ("Delta")[1] with infringement of U.S. Patent No. 3,409,579 and U.S. Patent No. 3,676,392. After an 11 day trial in the Fall of 1980, on March 26, 1981 the District Court [2] found that all of the claims in issue of both patents were invalid for obviousness; that all claims of the later issued patent were invalid for double patenting; and that the accused products did not infringe either patent.

On June 7, 1982 the Court of Appeals for the Seventh Circuit [3] sustained judgment of the District Court with respect to invalidity of the claims in issue and non-infringement. Ashland's Petition For Certiorari[4] was denied April 18, 1983.

B. Proceedings Below—Detroit

On March 4, 1982 Ashland filed suit in the Eastern District, Southern Division of Michigan (Detroit) under 28 USC 1338 charging Delta and several unnamed employees with infringement of U.S. Patent No. 3,485,797 and for misappropriation of trade secrets.[5]

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[1] Delta was then known as Delta Oil Products Corporation.

[2] The Decision of the Federal District Court in Milwaukee is reported at 212 USPQ 508.

[3] The Decision of the Court of Appeals, which is reported at 685 F.2d 175, reversed the judgment of invalidity of Claims 2-15 and 17 of the '392 patent for double patenting because these claims were not properly before the District Court. Ashland's Petition for rehearing and suggestion for rehearing *en banc* was denied October 5, 1982.

[4] No. 82-1090

[5] In an amended complaint, filed on or about September 3, 1982, Ashland added the names of Horstman, Lukacek and Kancius as defendants and added three more causes of action, all of which were based on misappropriation of trade secrets.

On March 4, 1983, Ashland filed another complaint in the United States District Court for the Eastern District of Michigan, Southern Division (Detroit) charging Delta and Aristo Corporation (Delta's wholly owned subsidiary) with infringement of U.S. Patents No. 3,409,579 and No. 3,676,392, the same patents involved in the Milwaukee litigation.

The two Detroit cases were consolidated. After denying Defendants' Motion For Summary Judgment on the basis of non-infringement, the case was set for trial in January of 1984. Both parties presented trial briefs and proposed findings of fact and conclusions of law, along with a joint Pre-Trial Report. Due to the technical nature of the case, these 5 pretrial documents were in excess of 400 pages.

The case was tried before Chief Judge John Feikens, sitting without a jury. The trial included 10 days of live testimony and 2 days of oral argument.

Each party identified more than 500 Exhibits for the Detroit trial, including many which had been used in the Milwaukee trial. Many of the witnesses in the Detroit trial had testified in the Milwaukee trial and much of their testimony was the same. Numerous depositions and portions of the trial transcript of the 1980 Milwaukee trial were designated for inclusion on the Detroit record. Post-trial briefs were submitted on various issues, including the issue of obviousness.

On June 1, 1984 the District Court issued a 31 page Opinion finding that all patent claims in issue were invalid for obviousness in view of the prior art. The Court also found that none of the trade secret misappropriation allegations had been proven. The District Court Judgment was entered in August of 1984.

Pursuant to 28 USC 1294, Ashland appealed to the Court of Appeals for the Federal Circuit.[6] Oral arguments were

[6] The counts relating to misappropriation of trade secrets were not appealed.

presented March 3, 1985 and on October 25, 1985 the Court of Appeals handed down its 58 page Opinion which reversed the District Court Judgment of invalidity.

1. The Evidence At The Detroit Trial

Jordan Kopac, Delta's Chief Executive Officer, was Delta's only witness. He testified 4 days at trial (TT 641-936)*.

Following his graduation from college with a Bachelor's degree in chemistry and physics in 1961, Kopac was employed as a research chemist in various industries. In 1966 he joined Delta as a research chemist and gradually worked his way up to President of the corporation (TT 641-645). Kopac designed the procedure used by Delta to produce the phenolic resin which was accused of infringing the Ashland patents (TT 683-684).

One of the principal issues litigated at trial was whether the phenolic resins claimed by the Ashland patents were described in or were made obvious by the prior art. When Kopac began to testify about prior art phenolic resins and the prior art literature describing such resins, Ashland's counsel objected (TT 727) asserting that Kopac should not be allowed to testify as an expert because he had not been listed in the Pre-Trial Order as an "expert" witness. Ashland claimed that they were surprised. The Trial Court noted that the parties had been in litigation for nearly 10 years (TT 730), and overruled the objection stating:

> "Well, as I read the Federal Rules of Evidence on Expert Testimony, it's whatever can aid the trier of the fact in areas that the trier of fact doesn't have any knowledge of.
>
> He has testified as to his chemistry background, has he not?" (TT 728)

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* "TT" refers to the respective page of the trial transcript.

Kopac's subsequent testimony included a number of opinions concerning the prior art patents. Kopac also testified about the content of the prior art and as to the conclusions one skilled in the art would draw from the prior art. He explained why one skilled in the art would find it obvious to combine the teachings of the various prior art references relied upon by Delta. Kopac specifically testified that if one followed the teachings of a patent which issued to Rothrock in 1937, one would make the phenolic resins claimed by the Ashland '797 patent (TT 769). Kopac's testimony was in conflict with testimony of Ashland's experts on this point and other points regarding the meaning of the prior art to one skilled in the art.

Ashland did not object to any of Kopac's opinions on the ground that they lacked a factual basis.[7] Ashland moved to strike Kopac's testimony on the basis that he had previously admitted that he was not an expert in phenolic resins, relative to Ray Wendland, one of the experts designated by Delta in the Pre-Trial Order. The District Court denied the motion, saying, at best this would only go to the weight to be accorded Kopac's testimony (TT 852).

At the time of the trial, Judge Feikens was the Chief Judge of the Federal District Court in Detroit. He has been on the Federal bench since 1970. He was assigned both Detroit cases initially, and supervised the discovery and pre-trial phases of both cases throughout. During the trial, he asked numerous questions of counsel and, on occasion, of the witnesses.

2. The District Court Opinion

The District Court concluded that all of the patent claims in issue were invalid for obviousness. It is clear from the

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[7] Kopac testified (TT 770) that Delta had reproduced one example from the Rothrock patent and compared the resulting product against Delta's resin. Ashland objected to Kopac testifying about the results of these tests, based on hearsay, which objection was sustained by the Judge.

Opinion that the Court relied upon Kopac's testimony to make findings of fact as to what the prior art taught, what those skilled in the art would infer from the prior art, and the logic of combining the prior art references in a manner which led to the conclusion of obviousness.

The District Court made no explicit witness credibility determinations. However, the District Court Opinion includes negative comments with respect to the testimony of both of Ashland's two principal expert witnesses, indicating the Court did not find either witness particularly credible.

Dr. Kurt Frisch, one of Ashland's experts, testified about a theory of unobviousness[8] which Ashland has since abandoned. Judge Feikens discussed the testimony of Dr. Frisch (69a) and stated that his examination of the prior art "leads me to a contrary conclusion". This statement clearly infers that Judge Feikens did not view Dr. Frisch's testimony as being credible.

Dr. Robert Conley, Ashland's other outside expert, was also criticized by Judge Feikens, because Dr. Conley was unable to explain why the Robins resin would be unobvious to one skilled in the art. Judge Feikens concluded that Dr. Conley's testimony "does not attack the relevancy of Delta's prior art proof" (66a). Again, this clearly indicates Judge Feikens did not find Dr. Conley's testimony to be persuasive.

The findings of the District Court concerning the teachings of the prior art and the logic of combining the prior art, now held to be in error, were made by the District Court after hearing the experts testify. Because the expert testimony was conflicting, the findings had to have been based, at least in part, on the Trial Judge's credibility determination of these expert witnesses.

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[8] Dr. Frisch testified phenolic urethane foundry binders would have been unobvious because the prior art taught phenolic urethanes disassociated at elevated temperatures (TT 953, 956-957).

3. The Court of Appeals Decision

The Court of Appeals for the Federal Circuit ruled that the District Court had committed several reversible errors with respect to its evaluation of prior art and the logic of combining the prior art (specific errors concerning prior art noted at 25a,29a,30a,33a,35a,36a,37a,38a,40a&42a, although many of these are characterized as errors of law). In its conclusion, the Court of Appeals pointed to "combining the teachings of the Rothrock patent, Megson and Martin" and "combining the teachings of the Rothrock patent, the Japanese patent and Fraser" as fundamental errors (A pg. 57).

The Court of Appeals Decision asserts, without explanation, that Kopac "had not been qualified to testify as an expert witness" (pg. 10a, Note 11 and 23a—last 3 lines). The Court of Appeals further stated that there was no objective evidence to support Kopac's opinion as to what was taught by the prior art and that it was of "limited" probative value (23a and 26a, Note 21). The Court said: "Lack of factual support for expert opinion going to factual determinations, however, may render the testimony of little probative value in a validity determination.", twice citing *In re Atenpohl*[9], 500 F.2d 1151, 1158 (CCPA 1974), at 23a and again at 25a.

The subsequent portion of the Court of Appeals Decision (following 27a) does not refer to the Kopac testimony. The Decision contains numerous errors concerning interpretation of the prior art and the evidence produced at trial.[10] For example, the Court said: "Delta did not offer evidence that showed an

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[9] *Attenpohl* involved an *Ex Parte* appeal from the Patent Office, wherein all of the evidence had been presented by the Applicant to the patent Examiner in the form of Affidavits. Clearly *Atenpohl* did not involve a trial with the confrontation of witnesses and an opportunity for cross-examination.

[10] On November 6, 1985 Petitioner filed a Motion asking the Court of Appeals to correct two errors which are apparent on the face of the record, which was granted December 6, 1985.

enabling disclosure for the disclosed structure of Megson. . ." (28a). Kopac testified that those skilled in the art were aware of various avenues for preparing the structure of Megson[11], and that the prior art British Patent described a specific method of producing the Megson structure.

REASONS FOR GRANTING THE WRIT

A. The Court of Appeals For The Federal Circuit, Despite Its Technical Expertise, Should Not Be Allowed To Retry Cases Which Have Had A Full Trial At The District Court Level

The Court of Appeals discounted the findings of fact made by the District Court after a full trial. Some of the Trial Court's findings were obviously based on credibility determinations. The Court of Appeals made new findings of technical facts, including some not raised at trial, apparently based upon the Court's independent review of the prior art and the patents in suit. Making new factual findings at the appellate level conflicts with the requirements of Rule 52(a)[12] to give due regard to the opportunity of the Trial Court to judge the

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[11] Kopac testified that those skilled in the art were aware of various avenues for preparing the structure shown by Megson (TT 891). Kopac later testified that the British prior art patent described a method involving the use of bromine at the para position, condensing the components, then dehalogenating the condensate to end up with the structure shown in the picture labeled "A" in the Megson reference. He also pointed out that the structure would have been methylol terminated (TT 914-915).

[12] Rule 52(a) was amended, effective August 1, 1985, to provide that findings of fact based on documentary evidence, as well as oral evidence, shall not be set aside unless clearly erroneous.

credibility of the witnesses[13]. As this Court said in *Anderson v. City of Bessemer City, NC*, 470 US ____, 84 L. Ed 2d 518, 529-530 (1985):

> "But when a trial judge's finding is based on his decision to credit the testimony of one of two or more witnesses, each of whom has told a coherent and facially plausible story that is not contradicted by extrinsic evidence, that finding, if not internally inconsistent, can virtually never be clear error."

The Court of Appeals Decision did not point out any "extrinsic evidence" which contradicted Kopac's testimony or opinions. Accordingly, at the very least, his testimony must be deemed to be "plausible". Thus, this case is distinguishable on the facts from *U.S. v. U.S. Gypsum Co.*, 333 US 364, 396 (1948). Rule 52(a) "recognizes and rests upon the unique opportunity afforded the trial judge to evaluate the credibility of the witnesses and weigh evidence". *Inwood Laboratories, Inc. v. Ives Laboratories, Inc.*, 456 US 844, 855 (1982).

Our system of jurisprudence is based on the fundamental right of the accused to confront his accusers and to require the accuser to testify and submit to cross-examination in open court before 12 peers serving as the trier of fact. The entire system is predicated on the theory that the trier of fact observing the witnesses will be able to discern which witnesses to believe and thereby ascertain the truth. This theory is the basis for Rule 52(a).

It is important, as a matter of public policy, for a trial of a civil action to be conclusive in its outcome. As this Court noted in *Anderson v. City of Bessemer, NC, (supra)* at 84 L. Ed 2d 529:

> "The rationale for deference to the original finder of fact is not limited to the superiority of the trial judge's position to make determinations of credibility. The trial

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[13] If the District Court fails to make a finding because of an erroneous view of the law, the usual rule is to remand the case to permit the Trial Court to make the missing findings *Pullman-Standard v. Swint*, 456 US 273, 291 (1982).

> judge's major role is the determination of fact, and with experience in fulfilling that role comes expertise. Duplication of the trial judge's efforts in the Court of Appeals would very likely contribute only negligibly to the accuracy of fact determination at a huge cost in diversion of judicial resources. In addition, the parties to a case on appeal have already been forced to concentrate their energies and resources on persuading the trial judge that their account of the facts is the correct one; requiring them to persuade three more judges at the Appellate level is requiring too much . . . ".

The need for uniformity in Federal Court trial procedure provides another compelling public policy consideration. Federal District Court judgments are now reviewed by two Courts of Appeals—the Court of Appeals for the Federal Circuit for patent cases and the Regional Courts of Appeals in all other cases. District Court judges should not be required to make findings of fact using different standards of credibility determinations of live witnesses depending upon the type of case (*i.e.*, patent v. non-patent) being tried.

Not only does the trial provide the fact finder with an opportunity to observe the demeanor of the witnesses and thereby assess the credibility of the witnesses, but it places the trial judge in a position to ask questions during the trial as they may occur. Thus, "Face to face with living witnesses the original trier of the facts holds a position of advantage from which Appellate judges are excluded . . . ". *Wainwright v. Witt*, 469 US____, 83 L. Ed 2d 841, 858 (1985).

The Court of Appeals, below, alluded to this Court's Decision in *Anderson* (18a), but ignored the admonition of *Anderson* and made its own findings of fact, discounting the testimony presented by Delta. The trial judge obviously believed Delta's expert witness and did not find Ashland's witnesses credible. The Trial Court is permitted under the law to simply disregard the testimony of a witness who is not believed. *Bose Corporation v. Consumer Union of United*

States, Inc., 466 US 485, 80 L. Ed 2d 502, 524 (1984). Moreover, making "a choice between two permissible views of the weight of evidence is not 'clearly erroneous' ". *U.S. v. Yellow Cab Co.*, 338 US 338, 342 (1949).

In *Graham v. John Deere Co.*, 383 US 1, 17 (1966), this Court clearly stated that the obviousness of a patent claim is to be determined in the light of "several basic factual inquiries". The Court of Appeals for the Federal Circuit should not be allowed to overturn the credibility-based factual findings made by the District Judge after a full trial, on the pretext that the Court of Appeals is deciding the legal question of obviousness. The findings of fact produced by an experienced Federal Trial Judge after an extensive hearing of live expert witnesses should not be overturned if there is evidence in the record to support them.

The Court of Appeals for the Federal Circuit was created for the purpose of bringing uniformity to the application of the patent laws. No license was given, however, to alter the procedures by which trials are to be conducted, rules by which evidence is received or mechanism by which the District Court judgments are reviewed on appeal.

The Court of Appeals Opinion contains numerous technical errors, *e.g.*, Delta failed to offer evidence that the prior art showed how to make the Megson structure (*supra*, pg. 10). It is impossible to say whether these errors were made because the Court overlooked the evidence in the record or whether the Court simply discounted the testimony of Kopac. Irrespective of the reason, the existence of these errors in the Opinion demonstrates that the standards of review required by Rule 52(a) have not been met.

B. The Court Of Appeals For The Federal Circuit Should Not Be Allowed To Violate Due Process By Disregarding Testimony, Which The Trial Court Found To Be Persuasive, On The Basis Of An Evidentiary Defect Not Raised At Trial.

The trial in the instant case, like most other patent cases, was a battle of the experts, wherein one expert testified that the prior art showed factors which lead to a conclusion of obviousness of the patent in suit, while the other experts testified otherwise. The Trial Court made factual determinations based on the testimony it found most believable, *i.e.*, based on the demeanor, presentation, consistency and the other factors which are involved in the persuasion of the trier of fact that a witness is telling the truth.

At trial, Plaintiff's counsel objected to the opinion testimony of Kopac *only* on the basis that they were surprised. No objection was raised, as required by Rule 103, as to a lack of factual basis for any of the opinions.[14] The Trial Judge did not restrict in any way the cross-examination of Kopac by Plaintiff's counsel, but permitted counsel to ask any questions he wished. Thus, Ashland had a full opportunity, pursuant to Rule 705, to cross-examine Kopac as to the factual basis for his opinions.

The Decision of the Court of Appeals holding that the testimony of Delta's expert was not that of an expert and holding that it was not probative, in effect discounts this testimony entirely and is tantamount to holding that this testimony is inadmissible. Had an objection been raised at trial, as required by Rule 103, Delta would have had an opportunity to present evidence to show the factual basis for the opinions in question. Thus, the effect of this ruling, first made at the Appellate level, is to deprive Delta of the opportunity to present evidence and thus plainly deprived Delta of Due Process under the law.

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[14] Neither was this objection raised in Ashland briefs at the Court of Appeals.

Rule 705 provides that the factual basis for an expert's opinion need not be disclosed. This Court recently held that an expert's inability to recall the basis for an opinion did not render the opinions inadmissible, but merely goes to the weight of the evidence. *Delaware v. Fensterer*, 474 US ____, 88 L. Ed 2d 15, 21 (1985). Accordingly, the mere absence in the record of factual basis for an opinion is not sufficient grounds to exclude opinion evidence, particularly at the appellate level.

In *Wainwright v. Sykes*, 433 US 72, 90 (1977), the Court, when speaking of the trial process, said:

> "Society's resources have been concentrated at that time and place in order to decide, within the limits of human fallibility, the question of guilt or innocence of one of its citizens. Any procedural rule which encourages the result that those proceedings be as free of error as possible is thoroughly desired, and the contemporaneous-objection rule surely falls within this classification."

The decision by the Court of Appeals for the Federal Circuit that opinions of an expert witness which lack factual basis should be excluded from consideration is improper under Rule 705. Excluding such evidence when the opposing party failed to raise a timely objection is also improper under Rule 103 of the Federal Rules of Evidence. This result violates the principles of Due Process in depriving Delta of an opportunity to introduce evidence now held to be essential and in making *de novo* findings from which there is no appellate review except for review by this court.

CONCLUSION

The Court is no doubt aware that a plethora of previous Petitions for Certiorari have complained of the propensity of the Court of Appeals for the Federal Circuit to conduct a trial *de novo* in Rule 52(a) cases. Inevitably such petitions will continue until this Court takes steps to bring the Court of Appeals for the Federal Circuit into line with the other Regional Courts of Appeal with respect to its treatment of Rule 52(a). Because the situation in the present case is exaggerated as to the extent of the *de novo* treatment by the Federal Circuit, this case presents an excellent vehicle for this Court to correct this ongoing problem.

It is submitted that Due Process was violated in this case and that this Court ought to exercise its power of supervision by granting certiorari and issuing instructions to govern the Federal Circuit's review of findings of fact entered by United States District Courts. In the alternative, the Judgment of the Court of Appeals should be summarily vacated and the case should be remanded with instructions to permit the District Court to make new findings of fact on the issues as to which the Court of Appeals has held that the District Court had an erroneous view of the law.

Respectfully submitted,

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Dated December 24, 1985

APPENDIX

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

ASHLAND OIL, INC.,

Appellant

v. Appeal No. 84-1779

DELTA RESINS & REFRACTORIES,
INC., ET AL.,

Appellees

Bruce Tittel, Wood, Herron & Evans, of Cincinnati, Ohio, argued for appellant. With him on the brief was *William G. Konold.*

Donald E. Egan, Cook, Wetzel & Egan, LTD., of Chicago, Illinois argued for appellee.

Appealed from: United States District Court for the Eastern District of Michigan

Judge Feikens

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

ASHLAND OIL, INC., *Appellant*, v. DELTA RESINS & REFRACTORIES, INC., ET AL., *Appellees*.	Appeal No. 84-1779

DECIDED: October 25, 1985

Before MARKEY, *Chief Judge*, DAVIS and KASHIWA, *Circuit Judges*. KASHIWA, *Circuit Judge*.

Ashland Oil, Inc. (Ashland) appeals from the judgment of the United States District Court for the Eastern District of Michigan, Southern Division, holding claims 1, 2, 7 and 10 of U.S. Patent No. 3,485,797 (the '797 patent), claims 14 and 19 of U.S. Patent No. 3,409,579 (the '579 patent), and claim 17 of U.S. Patent No. 3,676,392 (the '392 patent) invalid under 35 U.S.C. § 103. We reverse and remand.

Background

Ashland is the assignee of the three patents involved in this case, which were issued to Dr. Janis Robins. These patents are directed to certain chemical products and processes finding ultimate use in the foundry industry. One method of forming metal castings in the foundry industry involves compacting sand around a pattern to form a sand mold, removing the pattern, and then pouring molten metal into the sand mold. This process often involves the use of internal sand cores around which the molten metal flows to produce various internal configurations.

A chemical binder, for example a phenolic urethane formed by reacting a phenol-formaldehyde resin with a hardener component, such as a polyisocyanate, and a curing agent, such as a tertiary amine, is mixed with the sand, causing the sand-binder mixture to harden at a predetermined rate. After the sand mold mixture has hardened, the mixture retains its shape during the pouring of the molten metal. After the metal solidifies the binder must break down to permit the sand to be readily dislodged from the casting.

An optimized sand-binder mixture should have a slow or negligible curing period after the initial mixing of the binder with the sand, i.e., the work time, followed by a period of rapid curing. During the work time, the sand-binder mixture remains flowable, due to negligible curing or hardening, to allow easy forming of the mixture to conform to the pattern. Rapid curing after the mold has been formed allows the sand-binder mixture to rapidly reach its hardened state, thus permitting initiation of molten metal pouring.

Ashland sued Delta Resins & Refractories, Inc. (Delta)[1] for infringement of claims 1, 2, 7 and 10 of the '797 patent, claims 14 and 19 of the '579 patent and claim 17 of the '392 patent. Claims 1, 2, and 7 of the '797 patent are directed to a process for producing a phenol-formaldeyhde resin which may be used in producing a chemical binder useful in the formation sand molds. Claim 10 of the '797 patent is directed to one of the resin products derived from this process.

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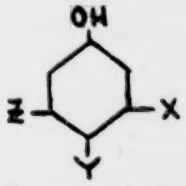
[1] The voluminous record submitted by the parties did not include a complaint listing the defendants in this case. The Joint Final Pretrial Report, paragraphs 5-8, indicates that, in addition to Delta Resins & Refractories, Inc., the named defendants are the Aristo Corporation, David Horstman, Lawrence D. Kancius and Gary Lukaceck.

Claim 1 of the '797 patent is a broad process claim[2] directed to reacting a phenol and aldehyde in the presence of a catalyst and reads as follows:

> 1. A process for the preparation of phenol aldehyde reaction products which comprises
>
> reacting a phenol having the general formula



> wherein X, Y, and Z are hydrogen, hydrocarbon radicals, oxyhydrocarbon radicals or halogen, with an aldehyde having the general formula R'CHO wherein
>
> R' is hydrogen or a hydrocarbon radical of 1-8 carbon atoms at a mole ratio of aldehyde to phenol of greater than 1,
>
> in the liquid phase under substantially anhydrous conditions with the removal of water above 100° C and
>
> at temperatures below about 130° C in the presence of catalytic concentrations of a soluble divalent metal salt dissolved in the reaction medium.

Claim 10 of the '797 patent is directed to a phenolformaldehyde resin (Pep resin)[3] and reads as follows:

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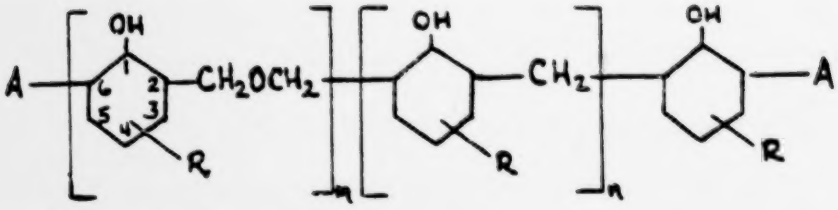
[2] Process claim 2 further limits the reaction temperature of the process from about 110 to 120° C. Process claim 7 limits the soluble divalent metal salt to salts of lead or zinc.

[3] The district court characterized the '797 resin of claim 10 as such and we adopt this terminology. Conventional phenolic resin chemistry describes two groups of phenolic resins: resoles and novolacs. Resoles are formed by reacting a phenol with excess formaldehyde in the presence of an alkaline catalyst while novolacs are formed by reacting an excess of phenol with formaldehyde in the presence of an acidic catalyst. R. MARTIN, THE CHEMISTRY OF PHENOLIC

(footnote continued on following page)

10. The phenol formaldehyde resin having the general formula



wherein R is hydrogen, hydrocarbon radical, oxyhydrocarbon radical or halogen, meta to the hydroxyl group of the phenol; m and n are numbers the sum of which is at least two and the ratio of m-to-n is greater than one; and A is a hydrogen or a methylol group, the molar ratio of said methylol group to hydrogen being at least one.[4]

Claim 14 of the '579 patent[5] is a dependent claim[6] directed to a foundry mix which contains sand as the major constituent

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(footnote continued from previous page)

RESINS, 88 (Fig. 2) (John Wiley & Sons, Inc. 1956). The use of the process of claim 1 to form the Pep resin requires that an excess of formaldehyde be reacted with phenol in the presence of a soluble divalent metal salt catalyst. The specification of the '797 patent teaches that the salt radical of the catalyst should be that of a stronger acid. Thus, the phenolic resin formed by the process of the '797 patent, as claimed in claim 10, fails to fall squarely into either group of phenolic resins described in the prior art, resoles or novolacs.

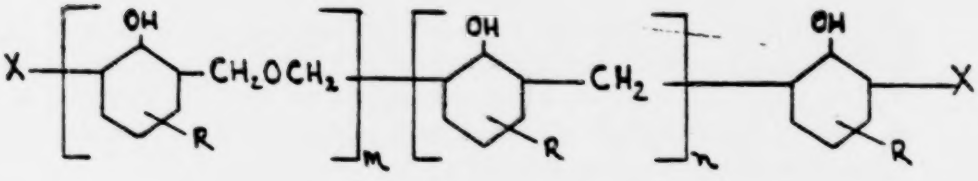
[4] The left hand phenol depicted *supra* has been labeled so that the ortho (2, 6), meta (3, 5) and para (4) positions are identifiable. CH_2-O-CH_2 identifies a benzylic ether bridge, CH_2 identifies a methylene bridge, OH is the chemical designation for a hydroxyl group, and CH_2OH is the chemical designation for a methylol group.

[5] In prior litigation between Ashland and Delta, claims 1, 13, 15, 16 and 18 of the '579 patent were invalidated for obviousness. *See Ashland Oil, Inc. v. Delta Oil Products*, 212 USPQ 508 (E.D. Wis. 1981), *rev'd in part*, 685 F.2d 175 (7th Cir. 1982), *cert. denied*, 103 S. Ct. 1769 (1983). None of these prior invalidated claims involved the Pep resin of claim 10 of the '797 patent.

[6] Claim 14 incorporates the binder composition of claim 6, claim 6 in turn being dependent upon claim 1, the broad binder composition claim of the '579 patent.

and up to 10% by weight, based upon the weight of the sand, of a binder composition. The binder composition comprises in admixture the Pep resin as described in claim 10 of the '797 patent, a hardener component comprising a liquid polyisocynate containing at least two isocyanate groups, and a curing agent comprising a tertiary amine.

Claim 19 of the '579 patent is a dependent claim[7] which reads as follows:

> 19. The process of preparing shaped foundry products which comprises:
>
> > (a) forming a foundry mix by uniformly distributing on a foundry aggregate containing sand as the major constituent a binding amount of up to 10% based on the weight of the aggregate of a binder composition obtained by combining [a phenolic resin having the general formula
>
> 
>
>
> > wherein R is hydrogen or a phenolic substituent meta to the hydroxyl group of the phenol, m and n are numbers the sum of which is at least 2, and the ratio of m-to-n is at least 1, and X is a hydrogen or a methylol group, the molar ratio of said methylol group-to-hydrogen being at least 1] and hardener component of claim 1, said polyisocyanate being employed in a concentration of 10 to 500% by weight of the phenolic resin;

---

[7] Claim 19 has been redrafted in the format of claim 15, with the addition of the relevant portion of claim 6, to facilitate review. Claim 19 is dependent upon claim 15, and incorporates the phenolic resin of claim 6, i.e., the Pep resin of claim 10 of the '797 patent.

(b) shaping the foundry mix in a mold; and

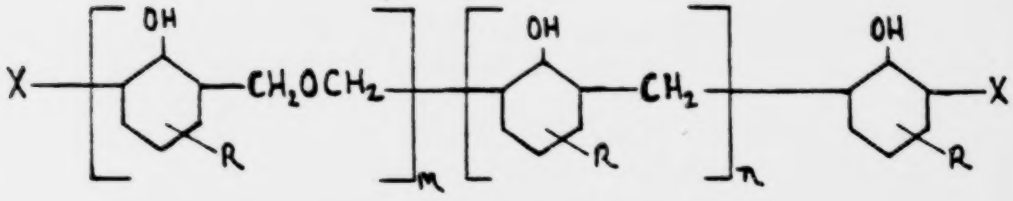
(c) contacting the shaped foundry mix with a tertiary amine until the binder is cured.

(bracketed material added, *see supra* note 7).

Claim 17 of the '392 patent[8] is a dependent claim[9] which reads as follows:

17. A foundry mix containing sand as the major constituent, and a binding amount of up to 10 percent based on the weight of sand of the resin composition [, said resin composition comprising in admixture,

a benzylic ether resin which has the general formula



wherein R is hydrogen or a phenolic substituent meta to the hydroxyl group of the phenol, m and n are numbers the sum of which is at least 2, X is an end-group from the group consisting of hydrogen and methylol, and wherein m is at least 1 and the sum of m and the number of methylol end-groups is at least two,

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[8] In the prior action between Ashland and Delta, *see supra* note 5, the district court had held all claims of the '392 patent invalid for obviousness. The Seventh Circuit reversed in part, holding that only claims placed in issue, in that case claims 1 and 16, were subject to invalidation. The invalidated claims were not directed to the use of the Pep resin.

[9] Claim 17 incorporates the resin composition of claim 1, with the additional limitation of claim 7 wherein the phenolic resin component is a benzylic ether resin. The relevant portion of claim 7 has been incorporated into claim 17 to facilitate review.

> a hardener component comprising a liquid polyisocyanate containing at least two isocyanate groups and present in an amount equal to 10 to 500 weight percent based on the weight of the resin, and
>
> a curing catalyst having a pK_b value in the range of about 7 to 11 and present in an amount equal to 0.01 to 10.0 weight percent based on the weight of the resin]. ·

(bracketed material added, *see supra* note 9).

District Court Proceedings

The district court noted that although the ultimate question of patent validity is a legal one, the determination of obviousness lends itself to several basic factual inquiries, to wit, the scope and content of the prior art, differences between the prior art and the claims at issue, and the level of ordinary skill in the pertinent art. The court recognized that Delta, as the party asserting patent invalidity, has the burden of proving that the claimed inventions in issue would have been obvious by clear and convincing evidence. Once Delta has established a *prima facie* case of obviousness, the burden of going forward shifts to Ashland to rebut with evidence of nonobviousness, although the burden of persuasion remains with Delta.

The court found that a person of ordinary skill in the art would have a bachelor's degree in chemistry, several years experience in phenolic and urethane chemistry, and several months exposure to the foundry art.

a. '797 Resin Claim:

The court stated that Delta relied primarily upon three prior art references to support its argument that the invention set forth in claim 10 would have been obvious: (1) U.S. Patent No. 2,079,633 (the Rothrock patent); (2) N. MEGSON,

PHENOLIC RESIN CHEMISTRY (Academic Press Inc. 1958); and (3) R. MARTIN, THE CHEMISTRY OF PHENOLIC RESINS (John Wiley & Sons, Inc. 1956).

Claim 10 of the '797 patent, the court stated, requires that the sum of m and n must be at least two such that Ashland's Pep resin must have at least three rings and may have up to forty. The Pep resin contains some three ring and greater molecules, along with a substantial amount of one and two ring adducts. The court found[10] that the process disclosed in the Rothrock patent produces claim 10 material, although having a large portion of adducts and only a small amount of three ring or greater molecules. Ashland denied that the Rothrock process produces the Pep resin of claim 10, and averred that the Rothrock resin is inferior to the Pep resin as a foundry binder because Rothrock's hydroxyl groups are modified by butyl alcohol solvents.

As to the MEGSON reference, diagram A, see Appendix, illustrates a polybenzylic ether resin within the scope of claim 10. The drawing shows phenol-formaldehyde resin molecules having an ortho-ortho orientation, connected by ether bridges, and an open para position. Claim 10 requires the sum of methylene and ether bridges to be at least two, and while the molecule of the diagram does not show methylene bridges, it is still within the scope of claim 10 because it satisfies the

[10] Ashland has argued that the district court made few factual findings, that the court was merely presenting the arguments of the parties. While the format of the court's opinion lends some credence to this argument, we note that the court properly recognized that it was required to make factual determinations on the scope and content of the prior art and the differences between the prior art and the Robins patents. *See Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966). Thus, the court's exposition appears to be the court's short-hand method of examining the prior art and the differences between the prior art and the patents in issue. Consequently, we review these statements by the court as its factual findings.

requirement that the sum of methylene and ether bridges with its two ether bridges. Ashland's position is that MEGSON does not disclose instructions for the preparation of this polybenzylic ether resin, and further that the molecule depicted in diagram A is only a hypothetical structure postulated to be present during curing, not what is present in a room temperature reaction product.

MARTIN discloses a linear polymeric ether resin containing up to thirty-five phenol rings linked together by ether bridges in an ortho-ortho orientation. Jordan Kopac, Delta's president,[11] testified that MARTIN teaches how ether linkages are formed, and how the number of ether linkages may be increased. Further, as temperature increases, some ether linkages will break down, producing methylene linkages and formaldehyde, the formaldehyde being available to cross-link the resin. The position of Ashland was that the open para position of the Pep resin allows phenol reaction at this site, an important consideration in producing a superior binder, but MARTIN teaches a structure which is para substituted.

Based upon this prior art, the court found that while no single prior art reference rendered the Pep resin of claim 10 obvious, the references taken together would have suggested that resin. *See Leinoff v. Louis Milona & Sons, Inc.*, 726 F.2d 734, 739, 220 USPQ 845, 848-49 (Fed. Cir. 1984). Therefore, Delta had sustained its burden of proving by clear and convincing evidence that the Pep resin of claim 10 would have been obvious to one of ordinary skill in the art.

The Rothrock patent, MEGSON, and MARTIN collectively suggest the critical elements of the claimed material, i.e.,

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[11] During pretrial discovery Delta had identified Dr. Raymond Wentland as its only expert witness. Dr. Wentland was not called to testify during trial. Instead, Delta chose to rely primarily on the testimony of Mr. Kopac, who although possessing the qualifications of one of ordinary skill in the art, had not been qualified to testify as an expert witness.

a phenol-formaldehyde resin containing linear polymers which consist of phenol rings connected by ether bridges or ether and methylene bridges in an ortho-ortho orientation having an unsubstituted para position.

The court held that Ashland's evidence was insufficient to rebut Delta's clear and convincing evidence that claim 10 would have been obvious to one skilled in the art in light of the prior art, and that Ashland failed to establish that one of ordinary skill in the art would have been unable to read the prior art references and "discover" the resin claimed by Robins.

b. '797 Process Claims:

The court stated that Delta had sustained its burden of proving by clear and convincing evidence that the prior art discloses reacting phenol with formaldehyde under essentially the same conditions as the Robins patent, finding that the prior art cited by Delta would have suggested to one of ordinary skill in the mid 1960s the possibility of developing the process claimed in claims 1, 2 and 7 of the '797 patent. The Rothrock patent describes a process for manufacturing phenol-formaldehyde resins, teaching a process using: (1) a formaldehyde/phenol ratio greater than 1; (2) paraformaldehyde (the anhydrous form of formaldehyde), and removal of water in some cases; a temperature range of 100-120° C; and (4) soluble metal salt catalysts, including zinc acetate.

Japanese Patent 13696/60 describes a process for producing phenol-formaldehyde initial condensates, by reacting phenol and formaldehyde: (1) under anhydrous polymerization conditions (starting with paraformaldehyde and removing water); (2) at temperatures above 100° C and as high as 120° C; and (3) using soluble metal salts as catalysts. Although the examples of the Japanese Patent teach a formaldehyde/phenol ratio less than 1, the specification teaches that a formaldehyde/phenol ratio greater than 1 may be used.

The prior art reference of Fraser, Hall & Raum, *Preparation of 'High-Ortho' Novolak Resins*, J. App. Chem. (Dec. 1957), teaches the effectiveness of zinc and lead as catalysts to form ortho-ortho linked phenol-formaldehyde chains, and that benzylic ether bridges are formed at reaction temperatures below 140° C.

There are differences between this prior art and the '797 process claims. The Rothrock patent does not teach removal of water above 100° C and the Fraser reference does not teach the removal of water at all. Both Rothrock and the Japanese Patent use butyl alcohol as a solvent, whereas Robins discloses the use of toluene. The '797 claims in issue, however, do not mention the use of solvents. The butyl alcohol modified resin of Rothrock is not a phenolic resin. Ashland has also argued that neither the Japanese Patent nor Fraser produce compounds with more than two rings.

But, the court stated that Ashland had failed to establish that these differences, in light of Delta's proof, are great enough to render the inventions in issue non-obvious. The cited references collectively, if not individually, teach: (1) a formaldehyde/phenol ratio greater than 1; (2) anhydrous conditions; (3) a reaction temperature range of 100-120° C; and (4) soluble metal salt catalysts. The differences between the prior art and the claims in issue are insignificant because one of ordinary skill in the art could study the prior art references and come upon the '797 process claims.

For example, one of ordinary skill could read Rothrock and recognize that varying the solvent in Example 5 and removing water—as Rothrock did in Examples 1 and 7—yields a process, which could be substantially similar to the '797 process, for preparing certain phenol-formaldehyde reaction products. Similarly, although the Japanese Patent and the Fraser reference do not produce compounds with greater than two rings, one of ordinary skill reading these pieces of prior art

could apply his knowledge and develop a process for preparing a phenolic resin which could be substantially similar to the process of the '797 patent.

c. The '579 and '392 Foundry Binder Claims:

The '579 and '392 foundry binder systems consist of the Pep resin, a polyisocyanate hardener, and a tertiary amine catalyst for the '579 claims or a catalyst with a pK_b value of about 7 to about 11 for the '392 claim.

Delta argued that the prior art, i.e., U.S. Patents Nos. 3,409,571 ('571 patent) and 3,398,122 ('122 patent) issued to Shepard and British Patent 1,031,909, disclosed the use of phenolic urethanes as foundry binders. Dr. Frisch, an expert witness, testified that Robins' foundry binder claims would not have been obvious to one skilled in the art. One skilled in the art would not expect polyurethanes to work as foundry binders since it was known in the field that reacting phenol with isocyanates results in a blocked phenol forming an unstable urethane which disassociates or reverts to phenol and isocyanates upon heating at temperatures of 140-150° C.

The court's examination of the prior art led it to conclude otherwise. While recognizing that the British Patent[12] was technically not prior art, it was indicative of what was known to persons of ordinary skill in the art. The patent described reacting novolac resins with highly reactive divalent materials to form a soluble product which can then be thermoset to

[12] The application on the British patent was filed in London on 5 November 1963 and published on 2 June 1966. This application was based upon a prior United States application, Serial No. 241,131, filed 30 November 1962. The application on the '797 patent was filed on 14 March 1962, the application on the '392 patent had a continuation-in-part filing date of 14 March 1962 and the application on the '579 patent had a continuation in-part filing date of 1 August 1966.

produce a foundry binder, and such a claim is made in claim 12. The court concluded that the British Patent discloses the use of phenolic urethanes as foundry binders.

The court found the Shepard patents significant in that Shepard described a novolac phenolic resin modified with a phosphorous compound, i.e., a soluble thermoplastic. Shepard's '571 patent clearly states that thermosetting products can be produced by mixing thermoplastic products with polyisocyanates, and that such thermosetting products are useful as foundry sand binders. Based upon the foregoing, the court concluded that the use of phenolic urethanes as foundry binders was taught by the prior art.

While Ashland argued that Shepard teaches the use of a novolac resin while the '579 and '392 claims here in issue use the Pep resin, the court found this difference insufficient to warrant a finding of nonobviousness. One skilled in the art could readily sense that the Pep resin might be substituted into the Shepard patent. It was known in the prior art how ether bridges and OH groups react with polyisocyanates. One skilled in the art could look at MEGSON, MARTIN and the Rothrock patent, analyze their teachings in light of Shepard and the British Patent, and conclude that a polybenzylic ether resin could be plugged into Shepard to produce a phenolic urethane foundry binder.

The court found that Delta had sustained its burden of proving that one of ordinary skill in the art of phenolic chemistry would have found it obvious to use tertiary amines to promote the reaction between the Pep resin and polyisocyanates. J. SAUNDERS & K. FRISCH, POLYURETHANES: CHEMISTRY AND TECHNOLOGY (Interscience Pub. 1962, reprint 1978), teaches that at low temperatures "one normally uses a catalyst such as a tertiary amine or aluminum chloride to promote this reaction." Further, Shepard's '571 and '122 patents, and U.S. Patent Nos. 3,242,107, 3,282,896, and

3,043,794 disclose that tertiary amines in lieu of or in addition to heat promote the reaction between phenolic resins and polyisocyanates.

The court also found that Delta had sustained its burden of proof to show that the use of a curing agent with a pK_b value of about 7 to about 11 to promote the reaction between the Pep resin and polyisocyanates would have been obvious to one of ordinary skill. The SAUNDERS reference disclosed work carried out in the 1940s involving catalysts with the pK_b range as claimed in claim 17 of the '392 patent which showed that base strength is a controlling factor of a catalyst's effectiveness in urethane formation. Moreover, the Shepard patents and U.S. Patent Nos. 3,156,659, 3,063,964, and 2,906,717 disclosed the use of various catalysts with a pK_b value in the range of claim 17 to promote the reaction between phenolic resins and polyioscyanates.

d. Secondary Considerations:

The court, citing to *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 105 S. Ct. 172 (1984), and *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983), stated that it had considered relevant secondary considerations before reaching the conclusion that the Robins' patents would have been obvious. The court noted that there were no independent secondary considerations relevant to the '797 patent apart from its use in Isocure, the commercial foundry mix patented under the '579 patent, and Pep Set, the commercial foundry mix patented under the '392 patent.

The court found the commercial success of Isocure and Pep Set impressive, noting that Ashland had sold millions of pounds annually of these products, and that both products enjoyed an increasing market share. While noting that Ashland had

granted licenses under these patents to Combustion Engineering Company and International Minerals and Chemical Company, the court further found that after Ashland lost the Milwaukee litigation Combustion Engineering sought a declaratory judgment that the patent claims here in suit were invalid, and subsequently settled for a renegotiated royalty rate decrease from 12.5% to 5%. International Minerals was found to have gone out of the business approximately one year after it was granted a license.

The court noted that Ashland had offered proof that Isocure and Pep Set had received recognition from the foundry industry in the form of awards and write-ups in trade publications. The court, however, found this recognition directed more towards the marketing of, rather than the invention of, these products. The court found it significant that Dr. Robins had not received any recognition from the industry and only $200 from Ashland for his role in developing Isocure and Pep Set.

The court stated that the law is well established that commercial success alone, or combined with other secondary evidence, is insufficient to establish patentability where primary indicia of patentability is lacking. After weighing Isocure and Pep Set's secondary considerations including commercial success against the primary indicia of obviousness—disclosures in the prior art—the court concluded that all the patent claims in suit were invalid for obviousness.

OPINION

A determination of whether the subject matter of claims in issue would have been obvious under 35 U.S.C. § 103 involves factual findings with respect to: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed subject matter and the prior art; and (4) where relevant, objective evidence of nonobviousness, e.g., long-felt need, commercial success, failure of others,

copying, unexpected results, i.e., the secondary considerations. *Perkin-Elmer Corp. v. Computervision Corp.*, 732 F.2d 888, 894, 221 USPQ 669, 674 (Fed. Cir. 1984); *Jones v. Hardy*, 727 F.2d 1524, 1527, 220 USPQ 1021, 1023 (Fed. Cir. 1984); *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1550, 220 USPQ 303, 311 (Fed. Cir. 1983), *cert. denied*, 105 S. Ct. 172 (1984). These factual findings serve as the foundation upon which the court bases its ultimate conclusion regarding the obviousness of the claimed subject matter as a whole. *Lear Siegler, Inc. v. Aeroquip Corp.*, 733 F.2d 881, 890, 221 USPQ 1025, 1033 (Fed. Cir. 1984). This court reviews the ultimate conclusion of obviousness as one of law on which it must exercise independent judgment. *Union Carbide Corp. v. American Can Co.*, 724 F.2d 1567, 1573, 220 USPQ 584, 589 (Fed. Cir. 1984).

A patent is presumed valid, and the burden of establishing invalidity as to any claim of a patent rests upon the party asserting such invalidity. 35 U.S.C. § 282 (1982). The presumption of validity is a procedural device that mandates that the party asserting invalidity bears the initial burden of establishing a *prima facie* case of obviousness under 35 U.S.C. § 103. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1534, 218 USPQ 871, 875 (Fed. Cir. 1983). Once a *prima facie* case has been established, the burden shifts to the patentee to go forward with rebuttal evidence showing facts supporting nonobviousness. *Ralston Purina Co. v. Far-Mar-Co, Inc.*, No. 84-1237, slip op. at 5 (Fed. Cir. September 5, 1985); *accord, In re Piaseki*, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984). The party asserting invalidity, however, always retains the burden of persuasion on the issue of obviousness until a final judgment is rendered. *Hughes Aircraft Co. v. United States*, 717 F.2d 1351, 1359, 219 USPQ 473, 478 (Fed. Cir. 1983); *Stratoflex*, 713 F.2d at 1534, 218 USPQ at 875. Each

fact forming the factual foundation upon which the court bases its ultimate conclusion regarding the obviousness of the claimed subject matter as a whole must be established by clear and convincing evidence. *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1459, 221 USPQ 481, 486 (Fed. Cir. 1984); *SSIH Equipment Co. S.A. v. United States International Trade Commission*, 718 F.2d 365, 375, 218 USPQ 678, 687 (Fed. Cir. 1983).

On appeal, however, the party subject to the adverse judgment on the issue of validity, in this case the patentee Ashland Oil, bears the burden of showing either that the district court committed reversible legal error in its ultimate conclusion as to obviousness, or that the district court's probative factual findings underlying its ultimate conclusion on obviousness were clearly erroneous.[13] *Fromson v. Advance Offset Plate, Inc.*, 755 F.2d 1549, 1555, 225 USPQ 26, 30 (Fed. Cir. 1985).

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[13] A finding is clearly erroneous when the appellate court, after reviewing the entire record, is left with the definite and firm conviction that a mistake has been made, even though there is some evidence in the record to support such a finding. *United States v. U.S. Gypsum Co.*, 333 U.S. 364, 395, 76 USPQ 430, 444 (1948); *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1458, 221 USPQ 481, 485 (Fed. Cir. 1984).

Further guidance as to the role of appellate review under the clearly erroneous standard has been provided by the Supreme Court in *Anderson v. City of Bessemer City, N.C.*, 105 S. ct. 1504, 1511, 1512 (1985), wherein the Court stated that:

> This standard plainly does not entitle a reviewing court to reverse the finding of the trier of fact simply because it is convinced that it would have decided the case differently.
>
> * * * *
>
> If the district court's account of the evidence is plausible in light of the record reviewed in its entirety, the court of appeals may not reverse it even though convinced that had it been sitting as the trier of fact, it would have weighed the evidence differently. Where there are two permissible views of the evidence, the factfinder's choice between them cannot be clearly erroneous.

A. CLAIM 10 OF THE '797 PATENT—PEP RESIN

The district court found that the Pep resin of claim 10 contained some three ring and greater molecules, along with a substantial amount of one and two ring adducts, that the process taught by the Rothrock patent produces claim 10 material, although having a large portion of adducts and only a small amount of three ring or greater molecules, that MEGSON taught phenol-formaldehyde resins having an ortho-ortho orientation, connected by ether bridges and having an open para position, and that MARTIN taught a linear polymeric ether resin having up to thirty-five phenol rings linked by ether bridges, some of these ether linkages breaking down at higher temperatures to produce methylene linkages and formaldehyde. Based upon these findings, the court concluded that the Pep resin of claim 10 of the '797 patent would have been obvious to one of ordinary skill in the art inasmuch as the Rothrock patent, MEGSON, and Martin collectively suggested the critical elements of Pep resin here at issue.

Before reviewing the factual findings made by the district court with respect to the teachings of each of the individual references, and the propriety of combining the teachings of these references, we find it appropriate to address several statements made by the district court. *See Union Carbide Corp.*, 724 F.2d at 1574, 220 USPQ at 590 (while faulty reasoning may lead to a wrong result, appellant must show not only error in reasoning but error in result).

A.1 Combining References

First, the court stated that Ashland had failed to establish that one of ordinary skill in the art would have been unable to read the prior art references and "discover" the Pep resin claimed by Robins. The law does not impose a burden on Ashland to establish that the *combined* teachings of the individual prior art references would not have led one skilled in

the art to discover the Pep resin of claim 10. The ultimate burden of establishing invalidity rests upon the party espousing such. *Stratoflex*, 713 F.2d at 1534, 218 USPQ at 875. Where the party asserting invalidity must rely upon a combination of prior art references to establish invalidity, that party bears the burden of showing some teaching or suggestion in these references which supported their use in combination. *W.L. Gore*, 721 F.2d at 1552, 220 USPQ at 312. It is legal error to place this burden on the patentee.

A.2 35 U.S.C. § 282

Further, if this statement is interpreted to place upon the patentee the burden of establishing the validity of his patents, it is at odds with established case law. Section 282 of Title 35 places the burden for the initial production of evidence, *Stratoflex*, 713 F.2d at 1534, 218 USPQ at 875, and the ultimate burden of persuasion on the issue of validity on the party asserting patent invalidity. *Hughes Aircraft*, 717 F.2d at 1359, 219 USPQ at 478; *Stratoflex*, 713 F.2d at 1534, 218 USPQ at 875. While the burden for the production of evidence shifts to the patentee once a *prima facie* case of invalidity is established, *Ralston Purina*, slip op. at 5; *Piaseki*, 745 F.2d at 1472, 223 USPQ at 788, the ultimate burden remains with the party asserting invalidity, in this instance Delta, to establish that the claims of the patents here at issue are invalid. There is no burden on Ashland to establish that the claims of these patents are valid, and it is impermissible for a trial court to shift this burden to the patentee. *Jones*, 727 F.2d at 1528-29, 220 USPQ at 1025.

A.3 Evidence vis-a-vis Obviousness

The court also held that Ashland's evidence was insufficient to rebut Delta's clear and convincing evidence on the obviousness of claim 10 of the '797 patent. While on this record we cannot say that this holding by the district court was

erroneous, it is open to an interpretation[14] at odds with the established case law, and for this reason we set forth a brief explication of the relevant legal principles. All facts relevant to the issue of obviousness, both the facts established by the party asserting invalidity *and* the facts established by the rebuttal evidence submitted by the patentee, must be fully considered by the court *prior* to reaching its conclusion on obviousness. *W.L. Gore*, 721 F.2d at 1555, 220 USPQ at 314; *Stratoflex*, 713 F.2d at 1539, 218 USPQ at 879. These facts must be established by clear and convincing evidence. *Lindemann Maschinenfabrik*, 730 F.2d at 1459, 221 USPQ at 486; *SSIH Equipment*, 718 F.2d at 375, 218 USPQ at 687.

A.4 The Pep Resin

The claims of a patent measure and define the invention. *Jones*, 727F.2d at 1024, 220 USPQ at 1024. A § 103 determination requires an evaluation of the prior art references with respect to the claimed invention. *Lear Siegler*, 733 F.2d at 890, 221 USPQ at 1033; *Union Carbide*, 724 F.2d at 1574-75, 220 USPQ at 590-91. The claims here in issue are to be read and

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[14] One possible interpretation of the district court's holding is that the district court evaluated the facts established by Ashland's rebuttal evidence solely on the basis of its ability to overcome or knockdown the legal inference of obviousness, i.e., Delta's facts establishing a *prima facie* case for obviousness. This approach was rejected in *In re Rinehart*, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976), wherein the court stated that facts established by rebuttal evidence must be evaluated along with the facts on which the earlier conclusion of obviousness, i.e., the *prima facie* case, was reached, not against the conclusion itself. *See Ralston Purina Co. v. Far-Mar-Co, Inc.*, No. 84-1237, slip op. at 5 (Fed. Cir. September 5, 1985). The ultimate conclusion on obviousness must rest upon an evaluation of *all* facts that have been established by clear and convincing evidence.

[15] Claim interpretation is a legal matter subject to review free of the clearly erroneous standard applicable to fact findings. *Raytheon Co. v. Roper Corp.*, 724 F.2d 951, 956, 220 USPQ 592, 596 (Fed. Cir. 1983), *cert. denied*, 105 S. Ct. 127 (1984).

construed[15] in light of the specification and prosecution history of the patent. *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 USPQ 929, 932 (Fed. Cir. 1984). The district court found that the Pep resin of claim 10 contained some three ring and greater molecules, along with a substantial amount of one and two ring adducts. This finding is clearly erroneous, being based upon a misconstruction of the governing law and an interpretation of claim 10 which is erroneous as a matter of law. *Cf. Lemelson v. United States*, 752 F.2d 1538, 1552, 224 USPQ 526, 534 (Fed. Cir. 1985).

The novel phenol-aldehyde resin *as claimed* in claim 10 is a linear phenolic resin wherein the sum of m and n must be at least two such that the phenolic resin as claimed comprises only molecules having three or more linked-phenol rings. Claim 10 does not claim one or two ring adducts, i.e., dimethylol phenols, benzylic ethers or methylene-bridged diphenols.[16] Relevant

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[16] The specification of the '797 patent teaches the formation of novel phenolic compositions characterized as a phenol-formaldehyde adduct or modified resole resin, which comprises one-ring dimethylol phenols and two-ring benzylic ethers and methylene-bridged phenols. The specification, however, also discloses that the novel phenolic resin of claim 10 is a higher molecular weight product formed by the condensation of the phenol-formaldehyde adduct. Further, the specification teaches that the "formation of the [phenol-formaldehyde] Adduct . . . is a precursor to the novel phenolic resins [as claimed in claim 10]."

While the specification is silent as to the actual chemical composition of phenol aldehyde reaction products produced by practicing the process disclosed in the '797 patent, Dr. Robins, the inventor, testified that the phenol aldehyde reaction product resulting from this process would comprise approximately 5-10% phenol formaldehyde resin as claimed in claim 10, with the remainder being monomers such as dimethylol phenols, benzylic ethers and methylene-bridged phenols.

The actual chemical composition of the reaction products produced by the '797 process, however, is irrelevant to a § 103 determination with respect to the *product* claimed in claim 10. The metes and bounds of claim 10 define the relevant product for the § 103 determination. *Lear Siegler*, 733 F.2d at 890, 221 USPQ at 1033.

prior art for this § 103 determination requires references which disclose phenolic polymers having three or more phenol rings, phenol rings linked by benzylic ether and methylene bridges, and phenol chains having at least one terminal methylol group.

A.5 Opinion Testimony

While objective factual evidence going towards a § 103 determination is preferable to statements of opinion on the issue, the nature of the matter sought to be established, as well as the strength of the opposing evidence, must be taken into consideration in asessing the probative value of expert opinion. *In re Oelrich*, 579 F.2d 86, 91, 198 USPQ 210, 215 (CCPA 1978). Opinion testimony rendered by experts must be given consideration, and while not controlling, generally is entitled to some weight. *See* FED. R. EVID. 701-704; *Orthopedic Equipment Co. v. United States*, 702 F.2d 1005, 1012, 217 USPQ 193, 199 (Fed. Cir. 1983). Lack of factual support for expert opinion going to factual determinations, however, may render the testimony of little probative value in a validity determination. *Cf. In re Altenpohl*, 500 F.2d 1151, 1158, 183 USPQ 38, 44 (CCPA 1974). While the opinion testimony of a party having a direct interest in the pending litigation is less persuasive than opinion testimony by a disinterested party, it cannot be disregarded for that reason alone and may be relied upon when sufficiently convincing. *Cf. In re McKenna*, 203 F.2d 717, 720, 97 USPQ 348, 350-51 (CCPA 1953).

The district court found that the process disclosed in the Rothrock patent produced claim 10 material having a large portion of adducts, with only a small amount of three phenol ring or greater molecules. The bases for this finding were the objective teachings disclosed in the Rothrock patent, the opinion testimony given by Jordan Kopac, Delta's CEO, who although not qualified as an expert was within the category of one skilled in the art as found by the district court, *see supra* note 11, and the opinion testimony of Dr. Robert Conley,

Ashland's expert witness. The court did not make any explicit credibility determinations with respect to the opinion testimony of Mr. Kopac and Dr. Conley, nor did the court give any indication as to the weight accorded this testimony.

A.6 The Rothrock Patent

The Rothrock patent disclosed a *process* for forming a heat-hardening unmodified phenol-formaldehyde resin.[17] There was no disclosure or teaching as to the chemical structure of this phenol-formaldehyde resin, i.e., what product was formed through the use of this process. *W.L. Gore*, 721 F.2d at 1550, 220 USPQ at 311. The district court did not point to any supporting statements or teachings in the Rothrock patent as a basis for its finding that the process of Rothrock produced a claim 10 phenolic resin.

Each element of a claim is material. *Lemelson*, 752 F.2d at 1551, 224 USPQ at 533. The process for producing the phenolic resin as claimed in claim 10 of the '797 patent requires the removal of water above 100 °C during the process.[18] This removal of water occurs during the condensation stage of the '797 process wherein the previously formed phenol-formaldehyde adduct is condensed to form the claim 10

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[17] The Rothrock patent taught only that the phenol-formaldehyde resin produced by the process disclosed therein was cured or heat-hardened by the addition of thermal energy to the resin. There was no disclosure that the resin was curable at room temperatures by the addition of an acid catalyst. The specification of the '797 patent, in contrast, teaches that the Pep resin is curable at room temperatures by the addition of an acid catalyst, or may be cured by the addition of thermal energy to the resin. *W.L. Gore*, 721 F.2d at 1550, 220 USPQ at 311 (a reference must have been considered in its entirety, for disclosures which taught way from the invention as well as disclosures which directed one skilled in the art towards the claimed subject matter).

[18] *See supra* note 16 and accompanying text.

product. The specification of the '797 patent teaches the importance of removing water during the condensation step.[19] There was no teaching in the Rothrock patent that water was to be removed *during* the disclosed process.[20]

There is no presumptive correlation that two similar processes form substantially the same product where the processes differ by a materially limiting step. *Cf. In re Hoeksema*, 399 F.2d 269, 274, 158 USPQ 596, 601 (CCPA 1968)(if the prior art of record failed to disclose a method for making a claimed compound, at the time the invention was made, it cannot be legally concluded that the compound itself was in the possession of the public).

There was no objective evidence to be gleaned from the Rothrock patent which would have supported a factual finding that the Rothrock patent produced claim 10 material. Concomitantly, there was no factual support for Mr. Kopac's opinion testimony with respect to the Rothrock patent, and consequently, Mr. Kopac's opinion testimony is of little probative value in a validity determination. *Altenpohl*, 500 F.2d at 1158, 183 USPQ at 44. Accordingly, the district court committed clear error when it found that the Rothrock process produced claim 10 material.[21]

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[19] The presence of water results in reaction products which cannot be cured to mechanically strong resins by the use of acidic reagents at room temperature. The presence of water affects not only the activity of the catalyst, but also the structure of the product formed, for example, permitting substitution at the para position.

[20] This statement will be more fully addressed in Section "B. THE PROCESS CLAIMS OF THE '797 PATENT", *infra*.

[21] The district court's factual finding that the process of the Rothrock patent produced claim 10 material is not plausible in light of the entire record. *Anderson v. City of Bessemer City, N.C.*, 105 S. Ct. 1504, 1512 (1985). There is no objective evidence disclosed in the Rothrock patent as to the nature of the product formed by the process

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A.7 The MARTIN Reference

MARTIN, the court found, disclosed a linear polymeric ether resin containing up to thirty-five phenol rings linked in an ortho-ortho orientation by ether bridges. A reference, however, must have been considered for all it taught, disclosures that diverged and taught away from the invention at hand as well as disclosures that pointed towards and taught the invention at hand. *W.L. Gore*, 721 F.2d at 1550, 220 USPQ at 311. While MARTIN taught a polymer having the phenol rings linked together by benzylic ether bridges, as well as at least one terminal methylol group, MARTIN also taught that this polymer had an "R" substituent at the para position. MARTIN taught that this R group was a substituent other than hydrogen. The polymeric resin of claim 10, in contrast, has an open or unsubstituted para position. Not only was the para position of the MARTIN compound blocked, there was no recognition that it would have been advantageous to replace the R substituent with a hydrogen, i.e., unsubstituted para position, to increase the polymer's reactivity.

A.8 The MEGSON Reference

The court found that the MEGSON reference illustrated a polybenzylic ether resin within the scope of claim 10, the drawing showing a phenol-formaldehyde resin molecule having ether bridge linkages at the ortho-ortho position and an open para position. The court found this molecule satisfied the m, n limitations of claim 10 by having at least two benzylic ether linking bridges, i.e., m equal to or greater than two while n

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disclosed therein. Delta did not proffer any objective evidence as to the type of phenolic resin produced by the Rothrock process. Mr. Kopac's opinion testimony as to what the Rothrock process produced is not substantiated by any objective evidence, and therefore can have probative value only as conjecture of one skilled in the art. *See* FED. R. EVID. 701. The evidence of record does not support the view that the Rothrock process produced claim 10 material. *Id.*

equals zero.[22] But, the MEGSON reference should also have been considered for disclosures that taught away from the invention here at issue. *Id.*, 220 USPQ at 311. The specific disclosure relied upon by the district court depicted two polymers cross-linked by a methylene derivative. Since this particular cross-linking mechanism was postulated to involve a reaction with nuclear hydrogen, the phenols of the polymers were shown as para unsubstituted, i.e., having hydrogen at the para position. The other cross-linking mechanisms, as well as a disclosure of a benzylic ether linked polymer product, depicted polymers having an "R" group at the para position. This R could have stood for hydrogen, or it could have stood for an

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[22] While we have reservations about this interpretation of claim 10, we will not, on the record before us, say it is erroneous as a matter of law. *ACS Hospital Systems*, 732 F.2d at 1577, 221 USPQ at 932. Under the court's interpretation when n is equal to zero, i.e., no methylene bridges, the ratio of m to n is undefined. But, whenever methylene bridges are present, i.e., n is a real number unequal to zero, the ratio of m to n is a finite real number. It is questionable whether the ratio of m to n would be a finite real number in all circumstances except one, where it is undefined.

The specification of the '797 patent indicates that the majority of linkages between the phenol rings will be benzylic ether such that the remainder of the linkages will be methylene. The specification also teaches that, at the temperatures at which condensation occurs to form the claim 10 material, some methylene linkages are formed.

Dr. Robins, however, gave testimony that n could equal zero, but this testimony was elicited in connection with a discussion as to whether the dimethylol phenols, benzylic ethers and methylene-bridged phenols are within the scope of claim 10. Dr. Robins also testified that the scope of claim 10 did not encompass the one or two phenol-ring adducts, but only polymers having three or more phenol rings. Dr. Conley, Ashland's expert, also testified that n could be equal to zero. *Anderson v. City of Bessemer City, N.C.*, 105 S. Ct. 1504, 1512 (1985) (where there are two permissible views of the evidence, the fact finder's choice between them cannot be clearly erroneous). The court's interpretation of this claim appears to have been predicated on the factual testimony proffered by Ashland's witnesses.

organic radical.[23] There was no teaching in the explication of the cross-linking mechanism as to what the terminal end groups of these cross-linking structures were, i.e., there was no teaching that these cross-linking structures had a methylol terminal end group. Finally, there was uncontroverted testimony by Ashland's expert, *see supra* note 23, that the disclosure in the MEGSON reference relied upon by the district court was a hypothetical structure.

The test of whether a particular compound described in the prior art may have been relied upon to show that the claimed subject matter at issue would have been obvious is whether the prior art provided an enabling disclosure with respect to the disclosed prior art compound. *Cf. In re Donohue*, 766 F.2d 531, 533, 226 USPQ 619, 621 (Fed. Cir. 1985); *Hoeksema*, 399 F.2d at 273-74, 158 USPQ at 598-99. Delta did not offer evidence that showed an enabling disclosure for the disclosed structure of MEGSON, while uncontroverted testimony showed the MEGSON structure to be a hypothetical structure.

A.9 Conclusion

The district court concluded, in light of the Rothrock patent, MEGSON, and MARTIN, that the Pep resin as claimed in claim 10 of the '797 patent would have been obvious. Obviousness, however, cannot be established by combining the teachings of the prior art to produce the claimed invention unless there was some teaching, suggestion or incentive in this prior art which would have made such a combination appropriate. *ACS Hospital Systems*, 732 F.2d at 1577, 221 USPQ at 933; *W.L. Gore*, 721 F.2d at 1551, 220 USPQ at 311. The

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[23] Dr. Conley testified that Megson's original work on this subject taught that the R group was an alkyl or aryl constituent. He also testified that the drawing cited by the district court, as well as the other two drawings relating to the cross-linking mechanism, were postulated or hypothetical structures to explain the cross-linking mechanism.

district court did not elucidate any factual teachings, suggestions or incentives from this prior art that showed the propriety of combination, nor in fact did the district court even point out what teachings from each of the references, when considered in combination, were relied upon in concluding that the invention of claim 10 would have been obvious. Nor apparently did the district court give any consideration to teachings in these references which would have led one skilled in the art away from the invention of claim 10. We would have to say that the district court used claim 10 of the '797 patent as a blueprint, and abstracted individual teachings from the Rothrock patent, MEGSON, and MARTIN to create the Pep resin of claim 10. *W.L. Gore*, 721 F.2d at 1552, 220 USPQ at 312. This was error as a matter of law.[24]

We are not persuaded, based upon the foregoing, that the facts upon which the district court based its legal conclusion that the subject matter of claim 10 of the '797 patent would

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[24] To properly combine references A and B to reach the conclusion that the subject matter of a patent would have been obvious, case law requires that there must have been some teaching, suggestion, or inference in either reference A or B, or both, or knowledge generally available to one of ordinary skill in the relevant art, which would have led one skilled in the art to combine the relevant teachings of references A and B. *See, e.g., ACS Hospital Systems*, 732 F.2d at 1577, 221 USPQ at 933; *W.L. Gore*, 721 F.2d at 1551, 220 USPQ at 311; *In re Sernaker*, 702 F.2d 989, 994, 217 USPQ 1, 5 (Fed. Cir. 1983). The decision maker's determination as to what objective evidence in reference A or B, or both, or generally available to one of ordinary skill in the relevant art, is of the nature of a factual finding.

The decision maker, however, after making findings as to the objective evidence, must subjectively analyze these factual findings to determine whether the teachings of references A and B could have been combined. Thus, the ultimate determination as to whether references could have been combined is a legal conclusion.

Where the district court fails to set forth the objective bases for its conclusion that references could have been combined, this court will review the determination as a matter of law.

have been obvious were proven by clear and convincing evidence, *Lindemann Maschinenfabrik*, 730 F.2d at 1459, 221 USPQ at 486; *SSIH Equipment*, 718 F.2d at 375, 218 USPQ at 687, such that it cannot be said that Delta had satisfied its burden of proof. Nor was there a sufficient basis for the district court to combine the teachings of the Rothrock patent, MEGSON, and MARTIN. *ACS Hospital Systems*, 732 F.2d at 1577, 221 USPQ at 933. The district court erred as a matter of law in concluding that the invention of claim 10 would have been obvious.

B. THE PROCESS CLAIMS OF THE '797 PATENT

The district court found that the Rothrock patent described a process for manufacturing phenol-formaldehyde resins wherein: (1) a formaldehyde/phenol ratio greater than 1 was taught; (2) the use of paraformaldehyde, the anhydrous form of formaldehyde, was disclosed; (3) a temperature range of 100-120 °C was taught; (4) the removal of water was taught in certain examples; and (5) the use of soluble metal salt catalysts including zinc acetate was disclosed. One point of contention[25] as to what the Rothrock patent disclosed was whether Rothrock

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[25] The Rothrock patent taught that formaldehyde and phenol were condensed in the presence of a mild acid catalyst and a completely volatile, non-gum-forming solvent selected from the class of monohydric aliphatic alcohols and mononuclear aromatic hydrocarbons. Ashland presented testimony, and argued before the district court and this court, that the use of butyl alcohol as the Rothrock solvent produced a butyl alcohol modified resin which was not a phenolic resin. The district court made a finding of fact to this effect. Ashland, however, has ignored the teaching of Rothrock that mononuclear aromatic hydrocarbons could have been used as the solvent, and that Example V taught the use of toluene, an aromatic hydrocarbon.

Although the process claims of the '797 patent do not have a specific limitation directed to a solvent, the process claims do require that the phenol and aldehyde be "in the liquid phase." The '797

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taught one skilled in the art the removal of water during the process which was consonant in scope to the water-removal limitation of the '797 process claims.

B.1 Robins' '797 Process

Process claim 1 of the '797 patent, an independent claim, describes a material claim limitation which requires the phenolic-resin producing reaction to be conducted "under substantially anhydrous conditions with the removal of water above 100 °C." The materiality of this limitation is disclosed in the '797 specification wherein it is stated that the "failure to *continuously* remove water not only affects the activity of the catalysts, but also the structure of the product formed, in permitting, for example, para-substitution", and that "the presence of water results in reaction products which cannot be cured to mechanically strong resins by the use of acidic agents at room temperature." (Our emphasis). The specification further discloses that the "process of the present invention is carried out in equipment which will provide for the *continuous* removal of water from the reaction mixture." (Our emphasis). The water-removal limitation of the process claims of the '797 patent, therefore, requires that water be continuously removed during the polymer formation stage of the reaction, *ACS Hospital Systems*, 732 F.2d at 1577, 221 USPQ at 932 (the claim here in issue is read and construed in light of the specification), i.e., at temperatures above 100 °C where the phenol-formaldehyde adduct—a mixture of dimethylol phenols, benzylic ethers and methylene-bridged phenols—is condensed to form the three-ring or greater phenolic resin.

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specification teaches that "[a]lthough it is not necessary to have an inert diluent present, it is generally preferred to conduct the reaction in the presence of one." The '797 specification further teaches that these solvents, when used, are non-polar organic solvents such as aliphatic, cycloaliphatic, aromatic and halogenated hydrocarbons. Toluene is set forth as a specific example of such a solvent.

B.2 The Rothrock Process

In contrast, the Rothrock patent in general did not teach or suggest the removal of water during the process described therein, nor was there any teaching or suggestion that the removal of water during the process was a critical limitation. More particularly, there was no teaching or suggestion that water was to be removed during the phenolic resin formation stage of the reaction, i.e., at temperatures above 100 °C. Only Example I of Rothrock disclosed a removal of water, teaching that a small amount of water which had formed on the sides of the reaction flask was removed from the resulting clear liquid formed by the process.[26] This water was removed, however, after the resin of the process had been formed, i.e., at temperatures well below 100 °C. The equipment for the process of Rothrock as disclosed in the examples did include an air condensor.[27] Mr. Kopac testified that there was no disclosure or teaching in the Rothrock patent of the function being performed by the air condensor, and that it could not be said with any certainty that the air condensor functioned to remove or retain water in the reaction zone during the Rothrock process. Examples II, III, IV, and VII of the Rothrock patent disclosed that the reaction mixture was heated at reflux.[28] This disclosure would have suggested to one skilled in the art that water was

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[26] Contrary to the district court's statement, Example VII of the Rothrock patent did not teach the removal of water. The only statement in Example VII with respect to water was that after the completion of the process, a clear solution was obtained "with traces of water on the sides of the flask."

[27] Mr. Kopac testified that an air condensor may be used, and depending upon its length, will condense certain vapors formed during the reaction in a manner so as to reintroduce these condensed vapors back into the reaction zone while unwanted vapors are transported outside of the reaction zone.

[28] Dr. Robins uncontroverted testimony was that reflux meant that water was being distilled from the reaction mixture, condensed, and returned to the reaction mixture.

not removed, nor was there any necessity for doing so, during the reaction process of Rothrock. *W.L. Gore*, 721 F.2d at 1550, 220 USPQ at 311 (a reference must have been considered in its entirety, for disclosures which taught away from an invention as well as disclosures which directed one to the invention). There was no clear teaching or suggestion in Rothrock that water was to be removed at any step during the condensation process disclosed therein, but rather only after the phenolic condensation was completed. Moreover, the Rothrock reference as a whole suggested that water was retained during the reaction process. *See supra* note 27 and text following, and note 28.

The district court found that the Rothrock patent had not taught the removal of water above 100° C. Yet, the district court subsequently found that one of ordinary skill could have read Rothrock and recognized that varying the solvent in Example V and removing water—as Rothrock had done in Examples I and VII[29]—yielded a process which could have been substantially similar to the '797 process. These findings by the court are in direct conflict. Since the '797 process claims contain a material limitation directed to "the removal of water above 100° C", *Lemelson*, 752 F.2d at 1551, 224 USPQ at 533, and since the district court found that Rothrock did not teach removal of water above 100° C, there was no basis for the court's finding that the Rothrock process was substantially similar to the '797 process since the Rothrock process lacked this material limitation. *See supra* note 21. Accordingly, we hold that this finding of the district court is clearly erroneous.

B.3 The Japanese Patent

The Japanese Patent, the court found, described a process for producing phenol-formaldehyde initial condensates, by reacting phenol and formaldehyde: (1) under anhydrous polymerization conditions, i.e., starting with paraformaldehyde

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[29] *But see supra* note 26.

and removing water; (2) at temperatures above 100 °C and as high as 120 °C; and (3) using soluble metal salts as catalysts. Further, the district court found that although the examples in the Japanese Patent taught a formaldehyde/phenol ratio less than 1, the specification taught that this ratio could be greater than 1.

While the process disclosed in the Japanese Patent did teach the use of paraformaldehyde, or another substance having the same effectiveness, and the continuous removal of water, the Japanese Patent should have been considered in its entirety, with due consideration given to disclosures that diverged or taught away from the invention here at issue, as well as disclosures which directed one skilled in the art to the invention. *W.L. Gore*, 721 F.2d at 1550, 220 USPQ at 311.

The Japanese Patent disclosed a process for producing a phenol-formaldehyde initial condensate in which phenol was added to a polar solvent such as ordinary alcohol, paraformaldehyde or a substance having similar effectiveness was dissolved into the phenol directly in a molar ratio range of 0.5—1.5 of formaldehyde/phenol, and this mixture was reacted in the presence of a weak alkaline catalyst[30] with the continuous elimination of water to produce a liquid mixture of 2-methylolphenol or 2-methylolphenol and 2, 6-dimethylolphenol. This resulting liquid mixture was then acidified to induce a condensation reaction to form 2, 2'-dihydroxydiphenyl methane and/or other methylolation products. The specification further taught that the hydroxide induced the ortho orientation of formaldehyde in a non-water system and that alkoxyphenoxymethane accelerated the ortho linkage during

[30] At one point in the specification the Japanese Patent taught that the alkaline catalyst could be selected from a group consisting of alkaline earth metal hydroxides, magnesium hydroxide, and alkoxyphenoxymethanes—the process disclosed therein was claimed in this manner—while at another point in the specification it was taught that both an alkaline catalyst and the alkoxyphenoxymethanes were used to produce the initial methylolphenol products.

condensation.[31] The specification further taught that the process reaction could have been effected without dissolving the phenol in a polar solvent, i.e., a solvent need not be used.

In contrast, the '797 specification teaches that the soluble metal salt catalyst is a metal ionically bonded to a salt radical, and that this salt radical should be that of a stronger acid, one having a dissociation constant greater than 10^{-8}, to prevent cross-linking during the formation of the reaction product. Further, while the process claims of the '797 patent do not incorporate a specific limitation calling for the use of a solvent, the specification discloses that in the preferred embodiment of the process a non-polar organic solvent is utilized. While the Japanese Patent taught that the use of a solvent was optional, it also taught that when a solvent was used, it must have a polar solvent. *W.L. Gore*, 721 F.2d at 1551, 220 USPQ at 311.

To the extent that the district court concluded that the Japanese Patent by itself would have rendered the subject matter of the process claims of the '797 patent obvious, this conclusion is erroneous as a matter of law. The Japanese

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[31] Delta argued that the Japanese Patent emphasized the importance of removing water in the process to produce the ortho-ortho orientation of the resultant phenolic resin. The Japanese Patent, however, taught that "in order to provide the ortho orientation to the resin, it is, of course, necessary to select the catalyst having the ortho orientation effect. . . ." Although it was taught that both the pH and water content of the reaction system affected the final product, the Japanese Patent clearly indicated that the alkaline catalyst was the dominant factor in producing the ortho-ortho orientation. Since the Japanese Patent disclosed that it was the anhydrous conditions and the alkaline catalyst in combination which produced the ortho-ortho orientation in the resultant product, there was no suggestion or inference therein to one skilled in the art that the removal of water in the Rothrock process, which cannot utilize an alkaline catalyst, would have been advantageous in effecting an ortho-ortho orientation in the resulting resin. *W.L. Gore*, 721 F.2d at 1551, 220 USPQ at 311.

Patent clearly taught, at a minimum,[32] that an alkaline catalyst, to induce the ortho orientation of the formaldehyde, was a material element of the process. *See supra* note 31. Moreover, the reaction of this process was a two stage reaction wherein the reactants were first exposed to an alkaline catalyst, and the resulting liquid mixture was then acidified to produce the final reaction product. The process claims of the '797 patent, in contrast, do not use an alkaline catalyst, nor is the '797 process a two stage reaction for the formation of a phenolic resin which requires initial reaction of the phenol and formaldehyde with an alkaline catalyst, and then the acidification of the resulting liquid mixture.

To the extent that the district court concluded that the teachings of the Japanese Patent could have been combined with the teachings of the Rothrock Patent to reach the conclusion that the subject matter of the '797 process claims would have been obvious, this conclusion is erroneous as a matter of law. *See supra* note 24. The district court did not point to any teachings or suggestions in either reference which would have led one skilled in the art to perceive an advantage to be derived from their combination. *ACS Hospital Systems*, 732 F.2d at 1577, 221 USPQ at 933; *W.L. Gore*, 721 F.2d at 1551, 220 USPQ at 311. In point of fact, the teachings of the two references would have led one skilled in the art away from their combination. Rothrock taught that his process could not be practiced using an alkali earth metallic hydroxide catalyst. In contrast, the Japanese Patent required such a catalyst. Rothrock required the use of a solvent, which could have been either polar or non-polar while the Japanese Patent taught that the use of a solvent was optional. Further, the Japanese Patent taught that when a solvent was used, it must be polar. The Japanese Patent also taught that the formaldehyde/phenol ratio could have a range of 0.5 -1.5 while Rothrock required that the ratio must be greater than 1.

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[32] *See supra* note 30.

B.4 The Fraser Reference

The district court found that the Fraser reference taught the effectiveness of zinc and lead as catalysts to form ortho-ortho linked phenol-formaldehyde chains and that ether bridges were formed at reaction temperatures below 140 °C. The court also found, however, that the Fraser reference did not teach the removal of water above 100 °C and that the method of Fraser did not produce compounds having more than two phenol rings.

A reference, however, should also have been considered for its antithetical teachings. *W.L. Gore*, 721 F.2d at 1550, 220 USPQ at 311. One of the critical teachings of Fraser was that the formaldehyde/phenol ratio must be less than 1, i.e., a molar excess of phenol was required for the method. It would be error as a matter of law if the district court concluded that the subject matter of the process claims of the '797 patent would have been obvious in view of the Fraser reference alone. Nor was there any teaching or suggestion that would have led one skilled in the art to combine the teachings of the Fraser reference with either the teachings of the Rothrock patent or the teachings of the Japanese Patent, or both. *ACS Hospital Systems*, 732 F.2d at 1577, 221 USPQ at 933.

B.5 Conclusion

We held *supra* that the district court's finding that the Rothrock process was substantially similar to the process of the '797 patent was clearly erroneous. Further, we are not persuaded that the other facts, discussed *supra*, which the district court relied upon in reaching its legal conclusion that the subject matter of claims 1, 2, and 7 of the '797 patent would have been obvious, were proven by clear and convincing evidence, *Lindemann Maschinenfabrik*, 730 F.2d at 1459, 221 USPQ at 486; *SSIH Equipment*, 718 F.2d at 375, 218 USPQ at 687, such that it cannot be said that Delta had sustained its

burden of proof before the district court. It was error as a matter of law for the district court to conclude that processes of claims 1, 2 and 7 of the '797 patent would have been obvious.[33]

C. THE CLAIMS OF THE '392 AND '579 PATENTS

Claim 17 of the '392 patent is directed to a foundry mix having sand as the major constituent and up to 10 percent by weight of sand of a resin composition. The resin composition comprises in admixture a benzylic ether resin substantially similar to the phenolic resin claimed in claim 10 of the '797 patent,[34] a hardener component defined as a liquid polyisocyanate, and a curing catalyst defined as a base having a pK_b value in the range of about 7 to about 11. Claim 14 of the '579 patent is directed to a foundry mix similar to that of claim 17, except that the phenolic resin of the binder composition is the resin as claimed in claim 10 of the '797 patent, and the curing agent is defined as a tertiary amine. Claim 19 of the '579 patent is directed to a process for preparing foundry shapes using the foundry mix of claim 14.

C.1 General Level of Skill in the Art

The district court found that British Patent No. 1,031,909, although technically not prior art, was indicative of what was

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[33] It appears that the district court used process claim 1 of the '797 patent as a blueprint, and abstracted individual teachings from the Rothrock patent, the Japanese Patent, and the Fraser reference to create the process of claim 1, without due consideration for teachings in these references that would have led one skilled in the art to find it improper to combine these references. *W.L. Gore*, 721 F.2d at 1552, 220 USPQ at 312.

[34] The phenolic resin of claim 10 of the '797 patent is defined such that m and n are numbers the sum of which is at least 2 and the ratio of m to n is greater than 1. In contrast, the benzylic ether resin as claimed in the foundry mix of claim 17 of the '392 patent is defined such that m and n are numbers the sum of which is at least 2, and wherein m is at least 1.

generally known during the relevant time frame to persons of ordinary skill in the foundry art. Finding that the British Patent described reacting novolac resins with highly reactive divalent materials[35] to produce soluble, fusible polymers which may be employed "as binders for sand (foundry resins)", the court concluded that the British Patent disclosed the use of phenolic urethanes as foundry binders.[36] The court also found that U.S. Patent Nos. 3,398,122 and 3,409,571 (the '122 and '571 patents, respectively), issued to Shepard, were significant for a teaching that phenolic urethanes were useful as constituents of foundry binders. Shepard, the court found, described a soluble thermoplastic, i.e., a novolac phenolic resin modified with a phosphorous compound, which could be mixed with polyisocyanates to form thermosetting products useful in foundry sand binders. Based upon the district court's findings with respect to the Shepard references, we cannot say that the district court erred in concluding that phenolic urethanes were taught as having utility in foundry binders.

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[35] The specification described these highly reactive divalent materials as "[a]ny diisocyanate in which the isocyanate groups are the sole reactive groups. . . ."

[36] Keeping in mind the admonishment that a disclosure should have been read in its entirety for all it divulged, *W.L. Gore*, 721 F.2d at 1550, 220 USPQ at 311, we have reservations about this finding of the district court. The specification of the British Patent stated that "[a]s far as [the inventors] are aware, soluble, fusible polymers which are the products of the reaction of a novolac resin and a highly reactive divalent material capable of condensing with phenolic hydroxyl groups have not heretofore been performed." The specification further stated that "the reaction of a conventional novolac polymer with such divalent reactants results in the production of the expected insoluble, infusible thermoset materials." From these disclosures in the British patent we would not say it was a foregone determination that the use of phenolic urethanes, prepared by the reaction of a resin with an isocyanate, in foundry mixes was known to those of ordinary skill in the foundry art as of the critical date.

C.2 The Shepard Patents

The district court found that one skilled in the art "could also readily sense that the 'Pep' resin might be substituted into the Shepard patent." Since it was known in the prior art how ether bridges and hydroxyl groups reacted with polyisocyanates,[37] one of ordinary skill in the art could have looked at the Rothrock patent, MEGSON, and MARTIN, analyzed their teachings in light of the Shepard patents and the British Patent,[38] and concluded that a polybenzylic ether resin could have been plugged into Shepard to produce a phenolic urethane foundry binder.

The district court's conclusion that the Pep resin might have been substituted for the phenolic condensate used in the Shepard patent is erroneous as a matter of law, for several alternative reasons.[39] First, the district court failed to consider the '571 patent in its entirety, in particular for those teachings therein that would have led one skilled in the art away from the subject matter of the '392 and '579 patents. *W.L. Gore*, 721 F.2d at 1550, 220 USPQ at 311. The specification of the '571 patent taught that the thermoplastic products of the invention could be used to produce thermosetting products by curing the thermoplastic products with agents, such as, *inter alia*, polyiso-

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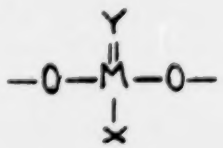
[37] On appeal, both Ashland and Delta have pointed out that this statement by the district court is technically incorrect in part. While polyisocyanates do react with hydroxyl groups, they do not react with benzylic ether bridges.

[38] The district court made a finding that the British Patent was not prior art. Therefore, the district court could only have utilized the British Patent in its "analysis" to the extent that the British Patent showed the general level of skill in the art as of the critical date. *Cf. In re Farrenkopff*, 713 F.2d 714, 219 USPQ 1 (Fed. Cir. 1983). *But see supra* note 36.

[39] Based upon the discussion *infra*, it is not necessary to review the factual findings made by the district court with respect to tertiary amines and curing catalysts having a pK_b value in the range of about 7 to about 11.

cyanates. The specification disclosed further that these thermoplastic products and/or thermosetting products were useful as foundry sand binders.

But, the district court failed to consider what these thermoplastic products were disclosed to comprise. The '571 specification disclosed that these thermoplastic products were polymeric esters characterized in that:

> (1) a major portion of the moiety of the member of the phosphorus family has the formula:
>
> 
>
> in which the unsatisfied bonds are attached to aryl nuclei of the same phenolic condensate, and in which M is an atom of the phosphorus family, Y is oxygen or sulfur, and X is halogen, hydroxyl, mercapto, hydrocarbyl, hydrocarbyloxy, halogen-substituted hydrocarbyl, halogen-substituted hydrocarbyloxy, or an aryloxy radical of the same phenolic condensate to which M is attached;
> (2) at least 60 percent of the phenol-aldehyde or phenol-ketone condensate has o,o'-alkylidene linkages, and;
> (3) the phenolic condensate has an average number of aryl nuclei per molecule in the range of 2.2 to 8.

Thus, the '571 specification taught that the thermoplastic product was more than a phenolic condensate. It was a phenolic condensate wherein a phosphorus-containing moiety had its unsatisfied bonds attached to the aryl nuclei of the same phenolic condensate. Even assuming arguendo that one skilled in the art might readily have sensed that the Pep resin of the '797 patent might have been used as the phenolic condensate called for by the Shepard patent, Shepard taught only that it was the polymeric ester or thermoplastic product, i.e., the phenolic condensate in combination with the bonded phosphorus-containing moiety, that could be reacted with

polyisocyanates or tertiary amines to produce thermosetting products having utility in foundry sand binders. But, the teachings of Shepard did not disclose to one skilled in the art whether the phenolic condensate, by itself, would have had utility as a thermosetting product.

The district court found that one of ordinary skill in the art would have looked at the Rothrock patent, MEGSON, and MARTIN, analyzed their teachings in light of the Shepard and British patents,[40] and concluded that a polybenzylic ether resin could have been plugged into Shepard to produce a phenolic urethane binder. Based upon our holdings in Section "A. CLAIM 10 OF THE '797 PATENT—PEP RESIN", *supra*, this conclusion is erroneous as a matter of law. In Section A we held that the Rothrock patent, MEGSON, and MARTIN, considered singly would not have led to the conclusion that the Pep resin as claimed in claim 10 of the '797 patent would have been obvious, and that there was no basis for combining the teachings of these references, such that one skilled in the art would not have had knowledge of the Pep resin as of the critical period. Therefore, there was no proper basis for the district court to conclude that one skilled in the art, even with knowledge of the teaching of the Shepard patent with respect to the utility of phenolic urethanes as foundry binders, would have had knowledge of a phenolic resin substantially similar to the phenolic resin as claimed in claim 10 of the '797 patent. Therefore, it was erroneous to conclude that the Pep resin of the '797 patent could have been substituted into the Shepard patent for use in producing a phenolic urethane foundry binder as taught in the Shepard patent.

C.3 Combining Prior Art with the Shepard Patents

Moreover, assuming for the sake of argument that the Rothrock patent, MEGSON, and MARTIN would have led one skilled in the art to a phenolic resin substantially similar to

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[40] *See supra* note 38.

the phenolic resin as claimed in claim 10 of the '797 patent, the '571 patent contained relatively little in the way of positive suggestion or inference which would have led one skilled in the art to combine the teachings of these references with the Shepard patent. *ACS Hospital Systems*, 732 F.2d at 1577, 221 USPQ at 933. The '571 patent taught two methods for the preparation of phenolic condensates having a high percentage of ortho-ortho alkylidene linkages.

The preferred phenolic condensate was prepared by reacting an excess of phenol with formaldehyde, i.e., a phenol/formaldehyde ratio greater than 1, in the presence of an inorganic alkali catalyst. In contrast, the Rothrock patent taught a formaldehyde/phenol ratio of 1:1, or a range of 1:63 to 1:1. Further, the Rothrock patent taught that the resins thereof could not be produced in the presence of alkali catalysts.

The alternative process for producing the phenolic condensates described in the '571 patent involved reacting an aldehyde with a phenol in the presence of an acid catalyst. The ratio of formaldehyde/phenol was described as being in the range of 0.5 to 1.0, with the preferred range being 0.7 to 0.9. Thus, while the '571 patent taught a formaldehyde/phenol ratio range wherein the upper bound minimally overlapped the lower bound of the Rothrock patent formaldehyde/phenol ratio, the preferred range taught in the '571 patent diverged away from the ratio as taught in Rothrock. The '571 patent also taught that the acid catalyst could be hydrochloric, sulfuric or oxalic acids, and was silent as to the need for a solvent to effect condensation. The Rothrock patent, in contrast, taught that condensation occurred in the presence of both a mild acid catalyst, such as zinc acetate, boric acid, or copper acetate, and a completely volatile, non-gum-forming solvent, and further that resins could not be produced in the presence of strongly acidic catalysts, such as hydrochloric acid. Since the '571 patent appeared to have suggested stronger acid catalysts than those usable in the Rothrock patent, and was silent as to the use of a

solvent, an uncertainty would have arisen as to whether the teachings of the Rothrock patent could have properly been combined with the teachings of the Shepard patent.

A further point is that the '571 patent taught that the phenolic condensate of the novel ester was one having at least 60 percent ortho-ortho alkylidene linkages. The specification disclosed that the term alkylidene expressed the structural relationship of the substituted methylene residues of the aldehyde to the phenolic nuclei of the phenolic condensates and that the term was intended to be generic to all such substituted methylene groups defined within the scope of the invention, and further taught that the phenolic condensates most useful in the invention were characterized by R_2-C-R_2 linkages, wherein R_2 could be independently selected from the group consisting of hydrogen, a hydrocarbon radical, and a halogen-substituted hydrocarbon radical. This teaching would have seemed to preclude the teachings of the Rothrock patent being combined with the teachings of the '571 patent inasmuch as the phenolic resin of the Rothrock patent which would have been substantially similar to the resin as claimed in claim 10 of the '797 patent would have had a majority of ether linkages,[41] not alkylidene linkages.

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[41] Claim 10 of the '797 patent requires that the phenolic resin claimed therein must have a ratio of m to n of greater than 1. To satisfy this constraint, m must be greater than n such that the number of benzylic ether bridges is always greater than 50 percent. The benzylic ether bridges are defined by the chemical formula CH_2-O-CH_2, and as such contain oxygen. In contrast, the specification of the '571 patent teaches that the preferred phenolic condensate must have at least 60 percent ortho-ortho alkylidene bridges, and that these bridges do not contain oxygen.

D. SECONDARY CONSIDERATIONS

The district court stated that it had considered relevant[42] secondary considerations prior to reaching its conclusion that the subject matter of the claims in issue of '392 and '579 patents would have been obvious. Thus, the district court seemingly recognized the holdings of this court vis-a-vis secondary considerations, to wit, that all relevant evidence going to the issue of obviousness/nonobviousness, which includes properly presented evidence on secondary considerations, must have been considered prior to reaching a conclusion on obviousness/nonobviousness. *Fromson*, 755 F.2d at 1556-57, 225 USPQ at 32; *W.L. Gore*, 721 F.2d at 1555, 220 USPQ at 314.

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[42] Case law requires that a nexus be established between the merits of the claimed invention and the evidence proferred on secondary considerations, if the evidence on secondary considerations is to be given substantial weight in the calculus of obviousness/nonobviousness. *Simmons Fastener Corp. v. Illinois Tool Works, Inc.*, 739 F.2d 1573, 1575, 222 USPQ 744, 746 (Fed. Cir. 1984), *cert. denied*, 105 S. Ct. 2138 (1985); *Stratoflex*, 713 F.2d at 1539, 218 USPQ at 879.

Ashland argued that the merits of its phenolic urethane foundry binder mixes—Isocure and Pep Set—were due to the characteristics of the phenol-formaldehyde resin, i.e., the Pep resin, substantially as claimed in claim 10 of the '797 patent. *See supra* note 34 and accompanying text. The district court did not make any explicit finding as to the nexus between the merits of the claimed invention and the proferred secondary considerations.

The district court at one point in the opinion stated that the Pep resin is an ingredient in Ashland's Isocure and Pep Set foundry binder mixes. The court stated that the main advantage of these products was the speed and timing of the cure, i.e., the "S" or "Z" cure curve, which increases foundry productivity.

Delta had argued before the district court that Ashland's Isocure and Pep Set foundry products were not covered by the '579 and '392 patents, respectively, because the Isocure and Pep Set foundry products have only an average of 2.5 phenol rings per molecule, whereas the claims of the '579 and '392 patents require an average of 3 or more phenol rings per molecule. The district court stated that

(footnote continued on following page)

The district court, however, also averred that the law was well established that commercial success alone, or considered in combination with other secondary considerations, is insufficient to establish patentability where primary indicia of patentability was lacking.[43] Just as it is legal error for a district court to fail to consider relevant evidence going to secondary considerations, *Lindemann Maschinenfabrik*, 730 F.2d at 1461, 221 USPQ at

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(footnote continued from previous page)

since it had found the patents in suit to be invalid for obviousness under § 103, there was no need to determine whether the patents in suit covered Ashland's products. This was error as a matter of law. For secondary considerations to have probative value, the decision maker must determine whether there is a nexus between the merits of the claimed invention and the secondary consideration. *Simmons Fastener Corp.*, 739 F.2d at 1575, 222 USPQ at 746; *Stratoflex*, 713 F.2d at 1539, 218 USPQ at 879. Under the circumstances of this case, Ashland's proferred evidence of secondary considerations cannot properly be considered in reaching a conclusion on obviousness/nonobviousness unless the decision maker first determines that these secondary considerations are relevant to the subject matter as claimed. For example, had the decision maker made this determination in this case, and determined that the Isocure and Pep Set products were not covered by the '579 and '392 patents, respectively, then the secondary considerations would not have had any relevance to the obviousness/nonobviousness determination.

[43] For support for this proposition the district court cited to: *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 283, 189 USPQ 449, 453, *reh'g denied*, 426 U.S. 955 (1976) (1976) ("[P]roducing a desired result in a cheaper and faster way, and enjoying commercial success 'without invention will not make patentability.' "); *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.*, 340 U.S. 147, 153, 87 USPQ 303, 306 (1950), reh'g denied, 340 U.S. 918 (1951) ("But commercial success without invention will not make patentability."); and *Eltra Corp. v. Basic, Inc.*, 599 F.2d 745, 756, 202 USPQ 630, 640 (6th Cir.), *cert. denied*, 444 U.S. 942 (1979) ("Of course, commercial success and satisfaction of long-felt needs are alone not sufficient to establish that the product is the result of invention.").

488, it may be legal error for a district court to presuppose that all evidence relating to secondary considerations, when considered with the other *Graham*[44] indicia relating to the obviousness/nonobviousness issue, cannot be of sufficient probative value to elevate the subject matter of the claimed invention to the level of patentable invention. *Fromson*, 755 F.2d at 1556-57, 225 USPQ at 32; *Union Carbide*, 724 F.2d at 1573, 220 USPQ at 589 (this court reviews the issue of obviousness as one of law on which it must exercise independent judgment—we must be convinced not only that the decision maker engaged in faulty analysis in applying the law to the facts, but also that a correct application of the law to those facts would bring a different result).

The objective evidence of secondary considerations may in any given case be entitled to more or less weight, depending upon its nature and its relationship to the merits of the invention. *Stratoflex*, 713 F.2d at 1539, 218 USPQ at 879. Secondary considerations may be the most pertinent, probative, and revealing evidence available to the decision maker in reaching a conclusion on the obviousness/nonobviousness issue. *W.L. Gore*, 721 F.2d at 1555, 220 USPQ at 314.

While it is incumbent upon the decision maker to recognize that evidence of secondary considerations need not be necessarily conclusive on the obviousness/nonobviousness issue, *Fromson*, 755 F.2d at 1557, 225 USPQ at 32, the decision maker must also bear in mind that, under certain circumstances, the evidence of secondary considerations may be particularly strong and entitled to such weight that it may be decisive. For example, in *Simmons Fastener Corp. v. Illinois Tool Works, Inc.*, 739 F.2d 1573, 1575-76, 222 USPQ 744, 747 (Fed. Cir. 1984), the trial court concluded that the claimed invention would have been obvious in light of the teachings of the prior art. But, the trial court had failed to consider the evidence

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[44] *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966).

going to secondary considerations in arriving at this conclusion. Holding that the trial court erred as a matter of law by failing to consider the evidence of secondary considerations prior to arriving at its legal conclusion, this court, after considering the teachings of the prior art and the secondary considerations, reversed the decision of the district court.

While the district court in this case found the evidence of commercial success of the chemical sand binders claimed in the '392 and '579 patents impressive, the court found countervailing considerations in the evidence that: (1) after the Milwaukee litigation, *see supra* note 5, one Ashland licensee had effected a downward renegotiation of its royalty payment after initiating a declaratory judgment action against Ashland on the patent claims here in issue; (2) another Ashland licensee went out of the business approximately one year after the grant of the license; (3) industry recognition of the chemical sand binders as claimed in the '392 and '579 patents was directed more towards the marketing of these products rather than the invention thereof; and (4) Dr. Robins, the inventor listed in the '797, '392, and the '579 patents, had not received any recognition from the industry and only a small monetary consideration from Ashland for his role in developing these inventions. On the record before this court, we cannot say that these factual findings made by the district court were clearly erroneous. *See supra* note 13.

The record also reveals, however, that Ashland proferred other evidence of secondary considerations, to wit: (1) affidavits from its industrial customers attesting to the long-felt need satisfied by these chemical sand binders produced by Ashland; (2) the unexpected results, i.e., the "S" or "Z" cure curve, achieved by the '392 and '579 foundry mixes; and (3) the alleged copying by Delta of these chemical sand binders. The opinion rendered by the district court did not discuss these secondary considerations, *see also supra* note 42, and they apparently were not accorded any probative value or entered

into the final calculus on the issue of obviousness/nonobviousness. This was error as a matter of law. *Lindemann Maschinenfabrik*, 730 F.2d at 1461, 221 USPQ at 488.

Where the evidence of record is unchallenged as to secondary considerations ignored by the decision maker, this court may, as a matter of law, consider this objective evidence in reviewing the ultimate conclusion of obviousness/nonobviousness entered by the trial court. *Id.*, 221 USPQ at 488. However, where this evidence of record is controverted, as it is in this case, this court will normally remand to the district court for its initial consideration of this evidence. Under the circumstances of this case, however, where we have held that the prior art of record is insufficient to support the legal conclusion of obviousness rendered against the '392 and '579 patents, remand for the district court's consideration of the other evidence going to secondary considerations is not necessary. Nor is it necessary for this court to determine whether a proper consideration of this evidence would have resulted in a different conclusion as to the obviousness of the '392 and '579 patents by the district court. *Union Carbide*, 724 F.2d at 1573, 220 USPQ at 589.

E. CONCLUSION

We have held that the district court committed reversible error in combining the teachings of the Rothrock patent, MEGSON, and MARTIN to reach the conclusion that the subject matter of claim 10 of the '797 patent would have been obvious, and further, that these references, considered individually, would not have supported a conclusion that the subject matter of claim 10 would have been obvious.

We have further held that the district court committed reversible error in combining the teachings of the Rothrock patent, the Japanese patent, and Fraser to conclude that the invention of process claims 1, 2, and 7 of the '797 patent would

have been obvious, and that these references, considered singly, would not have supported a conclusion that the invention of these process claims would have been obvious.

We have also held that, inasmuch as one of ordinary skill in the art would not have had knowledge of the Pep resin as claimed in claim 10 of the '797 patent, there was no basis to substitute this resin into the Shepard patent and conclude that the foundry binder inventions of the '392 and '579 patents would have been obvious. Further, as a matter of law there was no basis in either the Shepard patent or the other prior art relied upon by the district court which would have led one skilled in the art to combine the teachings of this prior art with the teachings of the Shepard patent.

Finally, we have held that the district court erred as a matter of law in failing to consider all evidence going to the secondary considerations. And further, that the district court erred by failing to determine if there was the requisite nexus between the proferred evidence of secondary considerations and the merits of the claimed inventions of the '392 and '579 patents.

Accordingly, the decision of the district court that claims 1, 2, 7 and 10 of the '797 patent, claims 14 and 19 of the '579 patent, and claim 17 of the '392 patent are invalid is reversed.

The case is remanded for consideration of the infringement issue.

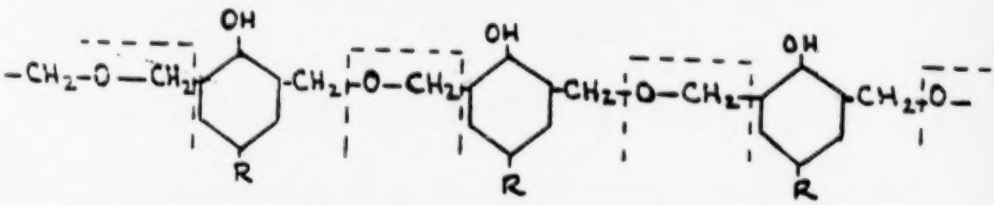
REVERSED AND REMANDED

APPENDIX

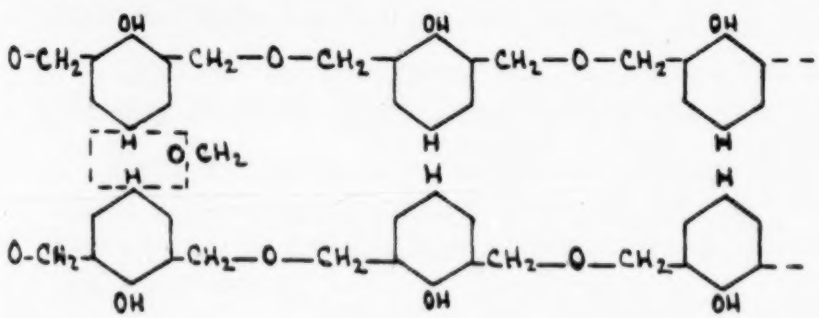
MEGSON, PHENOLIC CHEMISTRY, 29
(Academic Press Inc. 1958)

DETAILED SURVEY

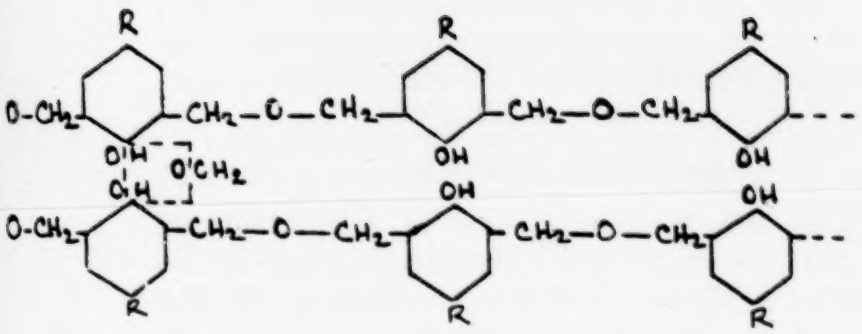
[missing text] with a dimethylene ether. It is believed, however, that methylene-bridged phenols are important constituents of resins resulting from the hardening of the alcohols, and if these are formed from the benzyl ethers, then elimination of formaldehyde should be much greater than that actually observed in the second stage of heating.



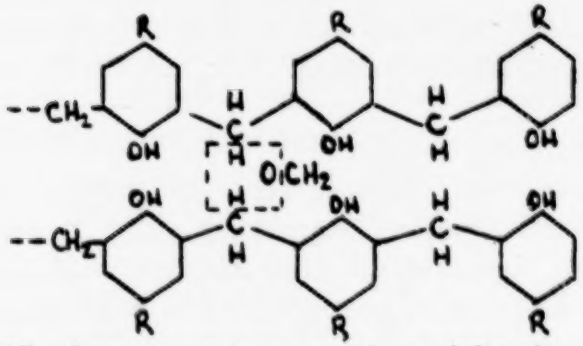
It appears, therefore, that much of the formaldehyde must recombine, and three methods are mentioned by which it can do this. The first involves reaction with nuclear hydrogens to give cross-linked methylene derivatives (A); the second involves reaction with phenolic hydroxyls to yield cross-linked ethers (B); the third involves reaction with methylene groups (when formed) to give cross-linked compounds of a different type (C).



A



B



C

All these reactions would explain the low evolution of formaldehyde and the high evolution of water during the second stage of hardening.

FILED
Aug. 14, 1984, 4:58 p.m.
U.S. District Court
Eastern Division

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF MICHIGAN

SOUTHERN DIVISION

ASHLAND OIL, INC.,
Plaintiff.

vs.

DELTA RESINS & REFRACTORIES, INC., et al.,
Defendants.

Civil Action Nos.
82 70966
83 CV 0806 DT

Judge
John Feikens

JUDGMENT ON DECISION BY THE COURT

This action came on for trial before the Court, Honorable John J. Feikens, Chief Judge, Eastern District of Michigan presiding, and the issues having been duly tried and a decision having been duly rendered,

It is Ordered and Adjudged that:

Defendant Delta Resins & Refractories, Inc. (hereinafter Delta) has not misappropriated any Ashland trade secrets;

Defendant Aristo Corporation (hereinafter Aristo) has not misappropriated any Ashland trade secrets;

Delta has not participated with any other corporations, including Aristo, to misappropriate any Ashland trade secrets;

Delta employees, past and present, including Defendant David J. Horstman, Defendant Lawrence D. Kancius and Defendant Gary Lukacek have not misappropriated any Ashland trade secrets;

There has been no conspiracy among Defendants or others to misappropriate any Ashland trade secrets;

Claims 1, 2, 7 and 10 of Robins Patent 3,485,797 are invalid for obviousness under 35 USC 103;

Claims 14 and 19 of Robins Patent 3,409,579 are invalid for obviousness under 35 USC 103; and

Claim 17 of Robins Patent 3,676,392 is invalid for obviousness under 35 USC 103.

It is further ordered that Delta's two (2) counterclaims be dismissed without prejudice with the stipulation that if the counterclaims are reasserted, they must be reasserted before this Court.

So Ordered:

JOHN FEIKENS
U.S. District Judge

Approved as to form:

BRUCE TITTEL
Bruce Tittel, Esquire
Attorney for Plaintiff

DONALD E. EGAN
Donald E. Egan
Attorney for Defendants

Dated at _____, this ____ day of _____, 1984.

_____
Clerk of Court

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF MICHIGAN

SOUTHERN DIVISION

ASHLAND OIL, INC.,

Plaintiff,

v.

DELTA RESINS & REFRACTORIES, INC., et al.,

Defendants.

Civil Action Nos. 82-70966 and 83-CV-0806-DT

AMENDED OPINION

Ashland Chemical Company (Ashland) brings this patent infringement action against Delta Resins & Refractories, Inc. (Delta). Ashland also asserts that Delta misappropriated its trade secrets. For reasons stated herein, I find that Ashland's patents are invalid for obviousness, and that Ashland has failed to sustain its burden of proving its trade secrets claim.

I. BACKGROUND

This case involves patents on certain chemical products used in the foundry trade. In the foundry industry, metal castings are formed by compacting sand around a pattern, removing the pattern, and pouring molten metal into the cavity thus formed. This process often involves making cores, around which metal is poured to produce various internal configurations. A chemical binder system holds the sand in shape while the metal is poured. After the metal solidifies, the binder must break down to permit the sand to be shaken out of the casting. Examples of foundry castings include door handles and cylinder bores in automobile engines.

Before the patents in suit were issued, foundry cores were formed by curing the binders in one of five processes: oven cure, hot box, CO_2 silicate, no bake, and the shell process. Each type of binder process offers certain advantages and disadvantages including the speed of the cure, the core's strength and dimensional accuracy, the amount of energy required to cure the core, its ability to be shaken out of the casting, the binder's shelf life, and the percent of core scrap.

In 1965, Ashland's predecessor hired Dr. Janis Robins to develop a binder system that would cure quickly at room temperature. Dr. Robins developed a polybenzylic ether ("Pep") resin. This resin is an ingredient in Ashland's foundry binder products—Isocure and Pep Set.

The main advantage these products offer is the speed and timing of the cure. When mixed, the binder does not cure immediately; rather, the sand remains flowable for a short time (called the "work time") and can be molded around a pattern. The amount of work time can be changed by varying the amount of catalyst in the binder. Then the binder cures very quickly, and the core thus formed is essentially ready to use. Graphically, when plotting time against compressive strength, these binders produce a sharper "S" curve than other binders. The "S" curve illustrates that the binder begins to cure slowly, approaches its maximum strength in a short period of time, and then gains very little additional strength as more time elapses. These curing characteristics increase foundry productivity.

A. *The Patents*

Ashland owns the three disputed U.S. Patents issued to Dr. Robins: 3,485,797 (797); 3,409,579 (579); and 3,676,392 (392). Ashland accuses Delta of infringing claims 1, 2, 7 and 10 of 797; claims 14 and 19 of 579; and claim 17 of 392. The phenolic resin patented under 797 is a component of the foundry sand binders patented under 579 and 392.

The 797 patent (entitled "Phenolic Resins Containing Benzylic Ether Linkages And Unsubstituted Para Positions"), issued in 1969, claims a phenol formaldehyde resin. Claim 1 claims a process for reacting phenol with formaldehyde, where the ratio of formaldehyde to phenol is greater than one. The claim specifies the reaction to be 1) under substantially anhydrous conditions, 2) at a temperature between 100°C and 130°C and 3) in the presence of catalytic concentrations of soluble divalent metal salt. Claim 2 claims "[t]he process of claim 1 wherein the reaction temperature is from about 110-120°C." Claim 7 claims the process of claim 1 "wherein the divalent metal salt is a salt of lead or zinc." Finally, claim 10 illustrates the chemical structure of the claimed resin with a drawing of three phenolic rings linked together with ether and methylene bridges. These molecules, together with 1 and 2 ring molecules called adducts, form the resin component of the binder systems patented under 392 and 579.

The 579 patent (entitled "Foundry Binder Compositions Comprising Benzylic Ether Resin, Polyisocyanate, and Tertiary Amine"), issued in 1968, discloses a gas cured binder system comprised of a phenolic resin, a polyisocyanate (as a hardener) and tertiary amine (as a curing agent). Claim 14 claims "[a] foundry mix containing sand as the major constituent and a binding amount of up to 10% based on the weight of sand of the binder of claim 6." Claim 6 claims the three-part binder system where the phenolic resin is that claimed in claim 10 of the 797 patent. Claim 19 claims a process for preparing shaped foundry products wherein the resin component of the binder is the phenolic resin of claim 10 of the 797 patent.[1] Ashland

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[1] Claim 19 is dependent of claim 15, which claims:

The process of preparing shaped foundry products which comprises:

(a) forming a foundry mix by uniformly distributing on a foundry aggregate containing sand as the major constituent a binding amount of up to 10% based on the weight of the

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asserts that its product Isocure is patented under 579, and that Delta's Delta Kure infringes this patent.

Finally, the 392 patent (entitled "Resin Compositions") was issued in 1972, and claims a resin comprised of a phenolic resin, a polysiocyanate and a liquid curing agent with pK_b [2] value in the range of about 7 to about 11. Claim 17 of 392 claims "[a] foundry mix containing sand as the major constituent and a binding amount of up to 10 percent based on the weight of sand of the resin composition of claim 7." Claim 7 claims through claim 1, the three-part binder system where the resin component is the resin claimed in claim 10 of the 797 patent. Ashland asserts that its product Pep Set is patented under 392, and that Delta's Delta Set infringes.

B. *The Milwaukee Litigation*

Ashland and Delta are not strangers. They met in the United States District Court for the Eastern District of Wisconsin, where Judge Terence Evans found various claims of the 579 and 392 patents invalid for obviousness. *Ashland Oil, Inc. v. Delta Oil Products*, 212 U.S.P.Q. 508 (E.D. Wis. 1981), *revd. in part*, 685 F.2d 175 (7th Cir. 1982), *cert. denied*, 103 S. Ct. 1769 (1983). The United States Court of Appeals for the Seventh Circuit reversed the decision insofar as it invalidated all 17 claims of 392 for double patenting when only two of those claims were actually litigated before the District Court. In all other respects, the Evans' opinion was affirmed. The claims

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aggregate of a binder composition obtained by combining the phenolic resin component and hardener component of claim 1, said polyisocyanate being employed in a concentration of 10 to 500% by weight of the phenolic resin;

(b) shaping the foundry mix in a mold; and

(c) contacting the shaped foundry mix with a tertiary amine until the binder has cured.

[2] The pK_b value measures basicity.

before Judge Evans were similar though not identical to the foundry binder claims in suit here.

Judge Evans invalidated for obviousness claims 1, 13, 15, 16 and 18 of the 579 patent.[3] Claim 13 contains the same three-part foundry binder system claimed in claim 14 (in issue here) except the phenolic resin component differs. Claim 14 uses the "Pep" resin of the 797 patent (not in suit in Milwaukee) instead of a resole or novolac resin referred to in claim 13. Similarly, the only difference between claim 15 and claim 19 (in issue here) is that the latter uses the "Pep" resin and the former uses conventional resole resins.

Judge Evans also invalidated for obviousness claims 1 and 16 of the 392 patent.[4] Claim 16 contains the same foundry mix claimed in claim 17 (in issue here) except the latter uses the "Pep" resin while the former uses conventional phenolic resins. In sum, the difference between the claims litigated in Milwaukee and the foundry binder claims in dispute here is that the former involve conventional phenolic resins and the latter involve the "Pep" resin.

II. DISCUSSION

There are three independent legal requisites to a valid patent: utility, novelty and nonobviousness. *Armco, Inc. v. Republic Steel Corp.*, 707 F.2d 886, 889 (6th Cir. 1983);

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[3] The prior art which Judge Evans relied on included the Saunders & Frisch treatise Polyurethanes—Chemistry and Technology, U.S. Patent 3,242,107 to Bunge, U.S. Patent 3,034,794 to Feiler, U.S. Patents 3,409,571 and 3,398,122 to Shepard, U.S. Patent 3,282,896 to Einberg, and British Patent 1,031,909 to General Electric.

[4] The prior art which Judge Evans relied on primarily included the Saunders & Frisch treatise, U.S. Patent 2,906,717 to Sekmakas, U.S. Patent 3,156,659 to Robitschek, U.S. Patent 3,063,964 to Khawam, as well as the Feiler, Bunge and Shepard patents. *See* note 3, *supra*.

General Motors Corp. v. Toyota Motor Corp., 667 F.2d 504, 505 (6th Cir. 1981), *cert. denied* 456 U.S. 937 (1982); *American Seating Co. v. National Seating Co.*, 586 F.2d 611, 615 (6th Cir. 1978), *cert. denied*, 441 U.S. 907 (1979). The nonobviousness requirement is codified in 35 U.S.C. § 103 (1982):

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The United States Supreme Court interpreted this language in *Graham v. John Deere Co.*, 383 U.S. 1 (1966). The Court noted that although the ultimate question of patent validity is a legal one, *A. & P. Tea Co. v. Supermarket Corp.*, 340 U.S. 147, 155 (1950), the determination of obviousness or nonobviousness lends itself to several basic factual inquiries:

> Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy.

Graham, 383 U.S. at 17. The United States Courts of Appeals, including the new Federal Circuit, uniformly follow this test. *Environmental Designs v. Union Oil Co. of California*, 713 F.2d 693, 695 (Fed. Cir. 1983), *cert. denied*, 104 S. Ct. 709 (1984); *Shemitz v. Deere & Co.*, 623 F.2d 1180, 1184 (7th Cir.), *cert. denied*, 449 U.S. 921 (1980); *Eltra Corp. v. Basic Inc.*, 599 F.2d

745, 751 (6th Cir.), *cert. denied*, 444 U.S. 942 (1979); *Steelcase, Inc. v. Delwood Furniture Co.*, 578 F.2d 74, 78 (5th Cir. 1978), *cert. denied*, 440 U.S. 960 (1979); *Clark Equipment Co. v. Keller*, 570 F.2d 778 (8th Cir.), *cert. denied*, 439 U.S. 825 (1978).

Delta, as the party asserting patent invalidity, bears the burden of proving that the claims in issue are obvious in light of the prior art. Recent Federal Circuit decisions establish that facts relied on by a patent challenger to prove obviousness must be established by clear and convincing evidence, *Railroad Dynamics, Inc. v. A. Stucki Co.*, ____ F.2d ____, Jan. 25, 1984, Case No. 83-951/961 (Fed. Cir.); *American Hoist & Derrick Co. v. Sowa & Sons, Inc.*, 725 F.2d 1350, 1359-60 (Fed. Cir. 1984); *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1549 (Fed. Cir. 1983), although there is an earlier body of law to the contrary, *see, e.g., Eltra, supra* at 750; *Dickstein v. Seventy Corp.*, 522 F.2d 1294, 1297 (6th Cir. 1975), *cert. denied*, 423 U.S. 1055 (1976). Once Delta establishes a prima facie case of obviousness, the burden of going forward shifts to Ashland, as owner of the patents, to rebut with evidence of nonobviousness. *In re Nalbandian*, 661 F.2d 1214, 1218 (C.C.P.A. 1981); *Application of Fielder*, 471 F.2d 640, 642-43 (C.C.P.A. 1973). The burden of persuasion, however, remains with Delta as the party asserting invalidity. *See Astra-Sjuco, A.B. v. United States International Trade Commn.*, 629 F.2d 682, 688 (C.C.P.A. 1980); *Solder Removal Co. v. United States International Trade Commn.*, 582 F.2d 628, 632-33 (C.C.P.A 1978).

Accordingly, to determine whether Delta has met its burden of proving that the Robins patents are invalid for obviousness,[5] I must: 1) determine the level of ordinary skill in

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[5] Delta also argues that even if the patents in suit are nonobvious and valid, neither their products nor Ashland's products are covered by these patents. Delta argues that the patent claims involved here require an average of 3 or more rings per molecule in the entire resin, and that both Delta and Ashland's products contain an average of

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the art, 2) examine the prior art references and the differences between those references and the Robins patents and 3) look at secondary considerations as indicia of obviousness or nonobviousness.

A. *The Level of Ordinary Skill*

In determining obviousness under § 103, "it is important to remember that the criterion is measured not in terms of what would be obvious to a layman, but rather what would be obvious to one 'reasonably skilled in [the applicable] art.'" *Dann v. Johnston*, 425 U.S. 219, 229 (1976) (cite omitted). For the patents involved here, I find that a person of ordinary skill would have a bachelor's degree in chemistry, several years experience in phenolic and urethane chemistry, and several months exposure to the foundry art. This finding agrees with Judge Evans' holding that "a person with a bachelor's degree in chemistry plus two years of research experience in phenolic and polyurethane chemistry, preferably with additional work with foundry binders would appear to have 'ordinary skill in the art.'" *Ashland*, 212 U.S.P.Q. at 508.

B. *797 Prior Art*

1. *The Resin Claim*

Claim 10 illustrates the chemical structure of the claimed resin:

> 10. The phenol formaldehyde resin having the generai formula

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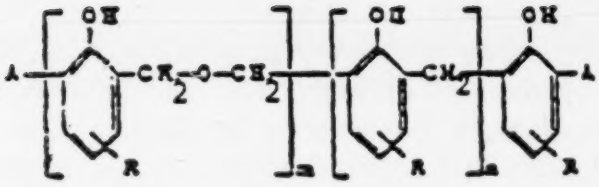
approximately 2.5 rings per molecule. Ashland argues that the patented resin contains both some claim 10 material as well as one and two ring adducts, and that the patents only require the claim 10 material, not the entire resin to have an average of three or more rings. Since I find that the patents in suit are invalid for obviousness under § 103, I need not reach the question whether the patents in suit cover Ashland's products, and if so whether Delta's products infringe.



wherein R is hydrogen, hydrocarbon radical, oxyhydrocarbon radical or halogen, meta to the hydroxyl group of the phenol; m and n are numbers the sum of which is at least two and the ratio of m-to-n is greater than one; and A is a hydrogen or a methylol group, the molar ratio of said methylol group to hydrogen being at least one.

The diagram shows three phenol rings linked together by an ether bridge (CH_2-O-CH_2) and a methylene bridge (CH_2). The algebraic brackets with the subscripts m and n indicate that these units may repeat, and the molecule may have considerably more than three rings. The patent requires the sum of m and n to be at least two; therefore, the molecule must have at least three rings, and may have up to 40 rings. The entire resin contains some three ring and greater molecules, along with a substantial amount of one and two ring molecules called adducts. The bridges connect the phenol rings at the ortho positions (two and ten o'clock positions), and the para position (six o'clock position) is unsubstituted, or open. Ashland asserts that the open para position produces a polyurethane which is superior for foundry use, and the ortho ortho orientation is much more reactive toward isocyanates than non-ortho ortho resins.

Delta relies primarily on three pieces of prior art to support its argument that claim 10 is obvious. First, it argues that the process described in U.S. Patent 2,079,633 issued to Rothrock in 1937 produces claim 10 material. Rothrock's procedure produces a small amount of 3 ring and greater molecules along with a large proportion of adducts. Although Rothrock did not

have the technology to identify the ether and methylene bridges, the process he describes nonetheless produces claim 10 material. Ashland, on the other hand, denies that the Rothrock process produces the Robins resin. It argues that the Rothrock resin is inferior to the claim 10 material as a foundry binder because Rothrock's hydroxyl groups are modified by butyl alcohol.

Second, Delta cites Megson, Phenolic Resin Chemistry (1958) as prior art. Megson discusses cross-linking phenolic resins and, Delta argues, diagram A (p. 29) illustrates a polybenzylic ether resin within the scope of claim 10. The drawing shows phenol-formaldehyde resin molecules in an ortho ortho orientation, connected by ether bridges, and an open para position. Although this diagram shows no methylene bridges, this molecule is still within the scope of claim 10. That claim requires the sum of methylene bridges and ether bridges to be at least two, and the Megson structure satisfies that requirement with its two ether bridges. Ashland, on the other hand, argues that this molecule is only a possibility of what occurs during curing, not what is present in a room temperature reaction product. The thrust of Ashland's argument is that Megson offers no clear instructions on how to prepare this hypothetical structure.

Finally, Delta relies on Martin, The Chemistry of Phenolic Resins (1956). Martin illustrates a linear polymeric ether resin which contains phenol rings linked together by ether bridges in an ortho ortho orientation. The diagram indicates that the polymer can consist of up to 35 units held together with ether links. Jordon Kopac, president of Delta, testified that Martin explains how ether links are formed, and how to increase the amount of these linkages. As temperature increases, some ether linkages will break down, which produces methylene linkages and formaldehyde. This formaldehyde is then available to cross-link the resin (tr. 772-85). Ashland argues that Martin differs from Robins in that the Martin structure is para substi-

tuted while claim 10 is para unsubstituted. The open para position allows the phenol ring to react at that site, which is important in producing a superior binder.

Based on this prior art, I find that Delta has sustained its burden of proving by clear and convincing evidence that claim 10 of the 797 patent is obvious to one of ordinary skill in the art. While no single piece of prior art renders claim 10 obvious, all the references taken together suggest the material claimed in claim 10. *See Leinoff v. Louis Milona & Sons, Inc.*, 726 F.2d 734, 739 (Fed. Cir. 1984) ("The question of obviousness depends, furthermore, on 'not only what the references expressly teach, but what they would collectively suggest to one of ordinary skill in the art.' " (cite omitted)); *In re Sernaker*, 702 F.2d 989, 994 (Fed. Cir. 1983) (obviousness will be found where "a combination of the teachings of all or any of the references would have suggested (expressly or by implication) the possibility of achieving further improvement by combining such teachings along the line of the invention in suit . . ."). A person of ordinary skill in the art, examining the Rothrock, Martin and Megson references, would see a phenol formaldehyde resin containing linear polymers consisting of phenol rings. These phenol rings are connected together by ether bridges or ether and methylene bridges in an ortho ortho orientation. Finally, the prior art, specifically Megson, discloses phenol rings with an open para-position. These references collectively suggest the critical elements of the claimed resin.

Ashland's evidence as to the differences between the prior art and claim 10 is insufficient to rebut Delta's prima facie showing of obviousness. Although differences exist between claim 10 and the prior art, Ashland failed to establish that one of ordinary skill in the art would be unable to read the prior art references and "discover" the resin claimed by Robins. Dr. Conley, President of the Union for Experimenting Colleges and Universities, testified for Ashland that in his opinion, the prior

art does not render the Robins resin obvious to one of ordinary skill. Dr. Conley also testified that the Robins resin was not obvious to him, even though he is an expert in phenolic chemistry (tr. 980-81). Yet this testimony does not attack the relevancy of Delta's prior art proof. While the prior art is not identical to claim 10, I hold that Ashland has failed to rebut Delta's clear and convincing evidence that claim 10 is obvious to one of ordinary skill in light of the prior art.

2. *The Process Claims*

Claim 1 claims a process for reacting phenol and formaldehyde where 1) the ratio of formaldehyde to phenol is greater than 1, 2) the reaction occurs under substantially anhydrous conditions, 3) the temperature range is between 100°C and 130°C and 4) the catalyst is a soluble divalent salt. Claim 2 claims the same process but specifies a temperature range of 110-120°C. Claim 7 claims the same process but specifies the divalent metal salt to be lead or zinc. Following this procedure produces the polymeric material illustrated in claim 10.

Delta has sustained its burden of proving by clear and convincing evidence that the prior art discloses reacting phenol with formaldehyde under essentially the same conditions as the Robins patent. The Rothrock patent, *supra*, describes a process for manufacturing phenol-formaldehyde resins. This patent illustrates a process using: 1) a ratio of formaldehyde to phenol greater than 1, 2) paraformaldehyde (the anhydrous form of formaldehyde) and removal of water in some cases, 3) a temperature range of 100-120°C and 4) soluble metal salts, including zinc acetate.

Japanese Patent 13696/60 relates to a process for producing phenol formaldehyde initial condensates. This process reacts phenol and formaldehyde: 1) under anhydrous polymerization conditions (starting with paraformaldehyde and removing water), 2) at temperatures above 100°C and as high as 120°C and 3) using soluble metal salts as catalysts. Although the examples illustrate a formaldehyde to phenol

ratio of less than 1, the patent states that a ratio of greater than 1 may be used.

The Fraser, Hall and Raum work, *Preparation of 'High-Ortho' Novolak Resins*, appearing in the Journal of Applied Chemistry in 1957, is also cited as prior art. This paper discusses the effectiveness of zinc and lead as catalysts to form ortho-ortho linked phenol-formaldehyde chains, and when reacted at temperatures below 140°C, benzylic ether bridges are formed.

There are differences, as Ashland points out, between claims 1, 2 and 7 and the cited prior art. Unlike Robins, Rothrock does not teach removal of water at temperatures above 100°C and Fraser does not teach removal of water at all. Both Rothrock and the Japanese Patent use butyl alcohol as a solvent, whereas Robins teaches the use of toluene. Further, the butyl alcohol modified resin produced by Rothrock is not a phenolic resin. Ashland also argues that neither the Japanese Patent nor Fraser produce compounds with greater than two rings.

Ashland, however, has failed to establish that these differences, in light of Delta's proof, are great enough to render the Robins patent nonobvious. The cited references collectively, if not individually, teach the critical features of Robins: 1) formaldehyde-phenol ratio greater than 1, 2) anhydrous conditions, 3) temperature range of 100°C to 120°C and 4) soluble metal salt catalysts. The claims themselves do not mention the use of solvents. Further, the differences between the prior art and claims 1, 2 and 7 are insignificant because one of ordinary skill in the art could study the prior art references and come upon the Robins process claims. For example, one of ordinary skill could read Rothrock and recognize that varying the solvent in example 5 and removing water (as Rothrock did in examples 1 and 7) yields a process for preparing certain phenol-aldehyde reaction products. This process could be substantially similar to

Robins. Similarly, although the Japanese Patent and Fraser paper do not produce compounds with greater than two rings, one of ordinary skill reading these pieces of prior art could apply his knowledge and develop a process for preparing a phenolic resin which could be substantially similar to Robins. In short, I find that the prior art cited by Delta would suggest to one of ordinary skill in the mid 1960's the possibility of developing the processes claimed in claims 1, 2 and 7 of the 797 patent.

C. *Foundry Binder Claims: 579 and 392 Prior Art*

Claim 14 of 579 and claim 17 of 392 claim foundry mixes made from phenolic urethanes. Claim 19 of 579 claims a process of preparing foundry shapes using the mix claimed in claim 14. The foundry binder systems consist of the Robins "Pep" resin, polyisocyanate, and a tertiary amine catalyst (for 579) or a catalyst with a pK_b value of about 7 to about 11 (for 392). The only difference between these 3 patent claims and those invalidated by Judge Evans is that the former use the Robins "Pep" resin while the latter use novolac or resole resins.[6]

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[6] Although the same patents that were involved in the Milwaukee case are present here, I am not collaterally estopped from deciding whether the claims before me are invalid for obviousness. The binders involved in the Milwaukee case contained a different resin component, and therefore, this case does not "present questions of fact identical to the questions presented in the [Milwaukee trial]." *Westwood Chemical Inc., v. Molded Fiber Glass Body Co.*, 498 F.2d 1115, 1117 (6th Cir. 1974). *See also Plastic Container Corp. v. Continental Plastics, Inc.*, 607 F.2d 885 (10th Cir. 1979). Delta argues that I am bound by several factual findings that Judge Evans made concerning the scope and content of the prior art. I need not consider this point because upon independent examination of the prior art, I reach the same conclusions that Judge Evans did. Delta also argues that I am bound by Judge Evans' finding concerning infringement. I need not address this point in that I base my holding on the patents' invalidity and do not reach the question of infringement.

1. *Phenolic Urethane Foundry Binders*

Delta argues that the prior art discloses the use of phenolic urethanes as foundry binders. It relies primarily on U.S. Patents 3,409,571 and 3,398,122 issued to Shepard, *et al.* in 1968, and British Patent 1,031,909 to support its assertion of obviousness.

Dr. Frisch, a professor of polymer chemistry and the Director of the Polymer Institute of the University of Detroit, testified that a person of ordinary skill would not have found the foundry binder claims obvious. He testified that it was known in the field that reacting phenol with isocyanates results in a blocked phenol forming an unstable urethane. This material disassociates or reverses to phenol and isocyanates upon heating at temperatures of 140°C to 150°C. Therefore, one of ordinary skill in the art would not expect polyurethanes to work as foundry binders. An examination of the prior art, however, leads me to a contrary conclusion.

The British patent was published on June 2, 1966, and was based on an application filed in Great Britain in 1963. This application was based on one filed in the United States in 1962. Though technically not prior art, this patent indicates what was known to persons of ordinary skill in the foundry art. The patent describes reacting novolac resins with highly reactive divalent materials to make a soluble product which can then be thermoset to produce a foundry binder. Claim 12 specifically claims "binders for sand." Based on my reading of the patent, I conclude that the British Patent discloses the use of phenolic urethanes as foundry binders. In examining the prior art in the Milwaukee litigation, Judge Evans also concluded that "the British Patent [describes] polyurethanes as thermoset compositions and specifically claims them as binders for sand . . . ." 212 U.S.P.Q. at 517.

More significant are the 571 and 122 patents issued to Shepard *et al.* Shepard describes a novolac phenolic resin

modified with a phosphorous compound. This material is a soluble thermoplastic. The 571 patent clearly states that thermosetting products can be produced by mixing thermoplastic products with polyisocyanates. Such thermosetting products are "useful ... as foundry sand binders." (571, Col. 7). Shepard goes on to say that the polyurethane products can be used as foamed products, castings, coatings and the like. Based on the foregoing, I find that Delta has sustained its burden of proving that one of ordinary skill in the art could read the Shepard patents, especially in combination with the British Patent, and conclude that phenolic urethanes are taught as foundry binders. Here too, Judge Evans and I agree. ("The Shepard '571 patent ... describes phenolic urethanes as thermoset materials that can be used as foundry binders." 212 U.S.P.Q. at 518.)

Ashland argues that even if Shepard teaches the use of phenolic urethanes as foundry sand binders, the Robins foundry binders are not obvious in light of Shepard's patents due to the differences between the two. Specifically, Shepard uses a novolac resin while Robins uses the "Pep" resin. This difference, however, is insufficient to warrant a finding of non-obviousness. Just as one "skilled in the art of phenolic resins could readily sense that a resole resin might be substituted for a novolac" in Shepard, *Ashland v. Delta*, 212 U.S.P.Q. at 519, he could also readily sense that the "Pep" resin might be substituted into the Shepard patent. It was known in the prior art how ether bridges and OH groups react with polyisocyanates. Accordingly, one of ordinary skill could look at Megson, Martin and Rothrock, analyze their teachings in light of Shepard and the British Patent, and conclude that a polybenzylic ether resin could be plugged into Shepard to produce a phenolic urethane foundry binder. The improvement achieved by this substitution "is that of the skillful mechanic, not that of the inventor." *Hotchkiss v. Greenwood*, 52 U.S. (11 How.) 248, 267 (1851).

2. *Catalysts*

a. 579 Catalyst: Tertiary Amines

The 579 patent (specifically claims 14 and 19 by reference) disclose the use of a tertiary amine as a catalyst to promote the reaction between the "Pep" resin and the polyisocyanate. Delta argues that the prior art discloses that tertiary amines accelerate the reaction between phenolic resins and polyisocyanates. Saunders & Frisch, Polyurethanes: Chemistry And Technology (1962, reprinted in 1978) states that at low temperatures "one normally uses a catalyst such as a tertiary amine or aluminum chloride to promote this reaction." Further, the Shepard patents, *supra*, U.S. Patent 3,242,107 issued to Bunge *et al.* in 1966, U.S. Patent 3,282,896 issued to Einberg in 1966, and U.S. Patent 3,043,794 issued to Feiler *et al.* in 1962, disclose that tertiary amines in lieu of or in addition to heat promote the reaction between phenolic resins and polyisocyanates. *See also Ashland v. Delta*, 212 U.S.P.Q. at 517. Based on these patents and the Saunders & Frisch work, I find that Delta has sustained its burden of proving that one of ordinary skill in the art of phenolic chemistry would find it obvious to use tertiary amines to promote the reaction between the "Pep" resin and polyisocyanates.

b. 392 Catalyst: pK_b Range

The 392 patent (specifically claim 17 through claim 7 and in turn through claim 1) discloses the use of a curing agent "having a pK value in the range of about 7 to about 11." Delta argues that the prior art discloses the use of such catalysts to promote the reaction between phenolic resins and polyisocyanates. Saunders & Frisch, *supra* at 138-39, refer to work done in the 1940's which showed that base strength is a controlling factor of a catalyst's effectiveness in urethane formation. This work involved catalysts in the pK range specified by Robins. Moreover, the Shepard patents, *supra*, U.S. Patent 3,156,659 issued to Robitschek in 1964, U.S. Patent 3,063,964

issued to Khawam in 1962, and U.S. Patent 2,906,717 issued to Sekmakas in 1955 disclose the use of various catalysts with a pK_b value in the range selected by Robins to promote the reaction between phenolic resins and polyisocyanates. Based on this prior art, I find that Delta has sustained its burden of proving that the use of a curing agent with a pK_b value of about 7 to about 11 to promote the reaction between the "Pep" resin and polyisocyanates would be obvious to one of ordinary skill. *See also Ashland v. Delta*, 212 U.S.P.Q. at 518-19.

D. *Secondary Considerations*

The Supreme Court suggests that secondary consideratio ıs such as commercial success, long felt but unsolved needs, failure of others, etc., may have relevancy as indicia of obviousness. *Graham v. John Deere Co.*, 383 U.S. at 17. Recent Federal Circuit cases emphasize that "[a]ll evidence bearing on the issue of obviousness ... must be considered and evaluated *before* the required legal conclusion is reached." *Gore and Associates v. Garlock, Inc.*, 721 F.2d 1540, 1555 (Fed. Cir. 1983), *Stratoflex Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983) ("Thus evidence rising out of the so-called 'secondary considerations' must always when present be considered en route to a determination of obviousness."). Accordingly, I have considered relevant secondary considerations before reaching the conclusion that the Robins patents are ob ious.

The 797 patent discloses the phenolic resin and processes for producing that resin. There are no independent secondary considerations relevant to the 797 patent apart from its use in Isocure (patented under 579) and Pep Set (patented under 392). Ashland has sold millions of pounds annually of these products, both of which enjoy an increasing market share. Ashland has granted licenses under these patents to Combustion Engineering Company (C.E. Cast) and International Minerals and Chemical Company (IMC).

After Ashland lost the Milwaukee litigation, C.E. Cast sought a declaratory judgment that the patents here in suit were invalid. The license was subsequently renegotiated reducing the royalty from 12-½% to 5%. About 1 year after Ashland granted the license to IMC, it went out of business.

Ashland offered proof that Isocure and Pep Set have received recognition from the foundry industry in the form of awards and write-ups in trade publications. This recognition, however, has been directed more towards the marketing of rather than invention of these products. Significantly, Dr. Robins has received no recognition from the industry and only $200.00 from Ashland for his role in developing Isocure and Pep Set.

While the secondary considerations, especially the commercial success of Isocure and Pep Set are impressive, I can only weigh these criteria as evidence of obviousness. The law is well established that commercial success alone, or combined with other secondary evidence is insufficient to establish patentability where primary indicia of patentability is lacking. *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 283 (1976) ("[P]roducing a desired result in a cheaper and faster way, and enjoying commercial success 'without invention will not make patentability.'" (citation omitted); *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.*, 340 U.S. 147, 153 (1950) ("But commercial success without invention will not make patentability."); *Eltra Corp. v. Basic, Inc.*, 599 F.2d 745, 756 (6th Cir. 1979) ("Of course, commercial success and satisfaction of long-felt needs are alone not sufficient to establish that the product is the result of invention.") In weighing Isocure and Pep Set's secondary considerations including commercial success against the primary indicia of obviousness (disclosures in the prior art), I nonetheless conclude that all the patent claims in suit are invalid for obviousness.

E. *Trade Secrets*

Finally, Ashland argues that Delta misappropriated its trade secrets relating to the manufacture of the "Pep" resin. There are three parts to this claim. Delta's first alleged misappropriation arises out of its purchase from IMC of its Detroit facility. IMC had a license agreement with Ashland, and because Ashland refused to permit IMC to transfer its technology to Delta, the IMC-Delta purchase agreement required IMC to remove all Ashland technology from the plant before Delta took over. When Delta took over the Detroit plant, it hired IMC's plant manager, who, without Delta's knowledge, kept copies of certain Ashland procedures. Ashland charges that the plant manager shared this technology with Delta's research chemist who produced four batches of resin with this procedure. Delta subsequently fired both the plant manager and research chemist. Second, Ashland charges Delta with misappropriating its refractive index end-point. The refractive index is a means of measuring how far a phenol-formaldehyde reaction has progressed. Ashland is not claiming that use of the refractive index itself is a trade secret; rather, it argues that it has a proprietary interest in the particular end-point at which it completes its cook. Third, Ashland claims that Delta misappropriated its trade secrets regarding the use of Aromatic Solvent 7545.

A trade secret may "consist of any formula, process, pattern, device or compilation of information that is used in one's business and which gives him an opportunity to gain an advantage over competitors who do not use it." *Allis-Chalmers Manufacturing Co. v. Continental Aviation and Engineering Corp.*, 255 F. Supp. 645, 653 (E.D. Mich. 1966). A trade secret will be afforded legal protection where 1) the claimed secret is not a matter of general or public knowledge, 2) the secret provides the holder with a business advantage, and 3) the holder has taken reasonable steps to protect the secret. *See*

Allis-Chalmers, 255 F. Supp. at 653; *Insealator Inc. v. Wallace*, 357 Mich. 233, 248 (1959). The thrust of a trade secrets claim is the betrayal of a trust, breach of a confidence, or impropriety in the method of ascertaining the secret. *See Insealator*, 357 Mich. at 250; *Russell v. Wall Wire Products Co.*, 346 Mich. 581, 585-586 (1956); Restatement, Torts § 757.

I find that Ashland has failed to establish by a preponderance of the evidence that Delta misappropriated its trade secrets. There was insufficient proof offered at trial to show that it was more likely than not that Delta used Ashland's procedures for manufacturing the "Pep" resin. Moreover, Ashland was unable to prove that it took reasonable steps to protect its claimed secrets and that Delta acted improperly in obtaining the disputed information.

Similarly, Ashland failed to prove that Delta's use of the refractive index was improper. The use of a refractive index to determine the end point in the production of phenolic resins is a matter of public knowledge. For example, Georgia Pacific and American Marietta used a refractive index to control manufacture of phenolics. Not only did Ashland fail to prove that its particular end-point is a trade secret, but U.S. Patent 4,311,619 issued to Seeney in 1982 discloses the use of an end-point in the production of a phenol-formaldehyde resin in the range selected by Ashland.

Finally, Ashland failed to produce any evidence from which I could conclude that Aromatic Solvent 7545 was a trade secret, and that Delta misappropriated it.

III. CONCLUSION

Delta has sustained its burden of proving by clear and convincing evidence that all of the patent claims in suit would have been obvious to one of ordinary skill in the art in light of the cited prior art. Consideration of the secondary indicia of

obviousness does not alter my conclusion. I also find that Ashland has failed to support its allegations that Delta misappropriated Ashland's trade secrets.

An appropriate order may be presented.

JOHN FEIKENS
John Feikens
Chief United States
District Judge

Dated: Aug. 14, 1984

A TRUE COPY

Clerk, U.S. District Court
Eastern District of Michigan

By
Deputy Clerk